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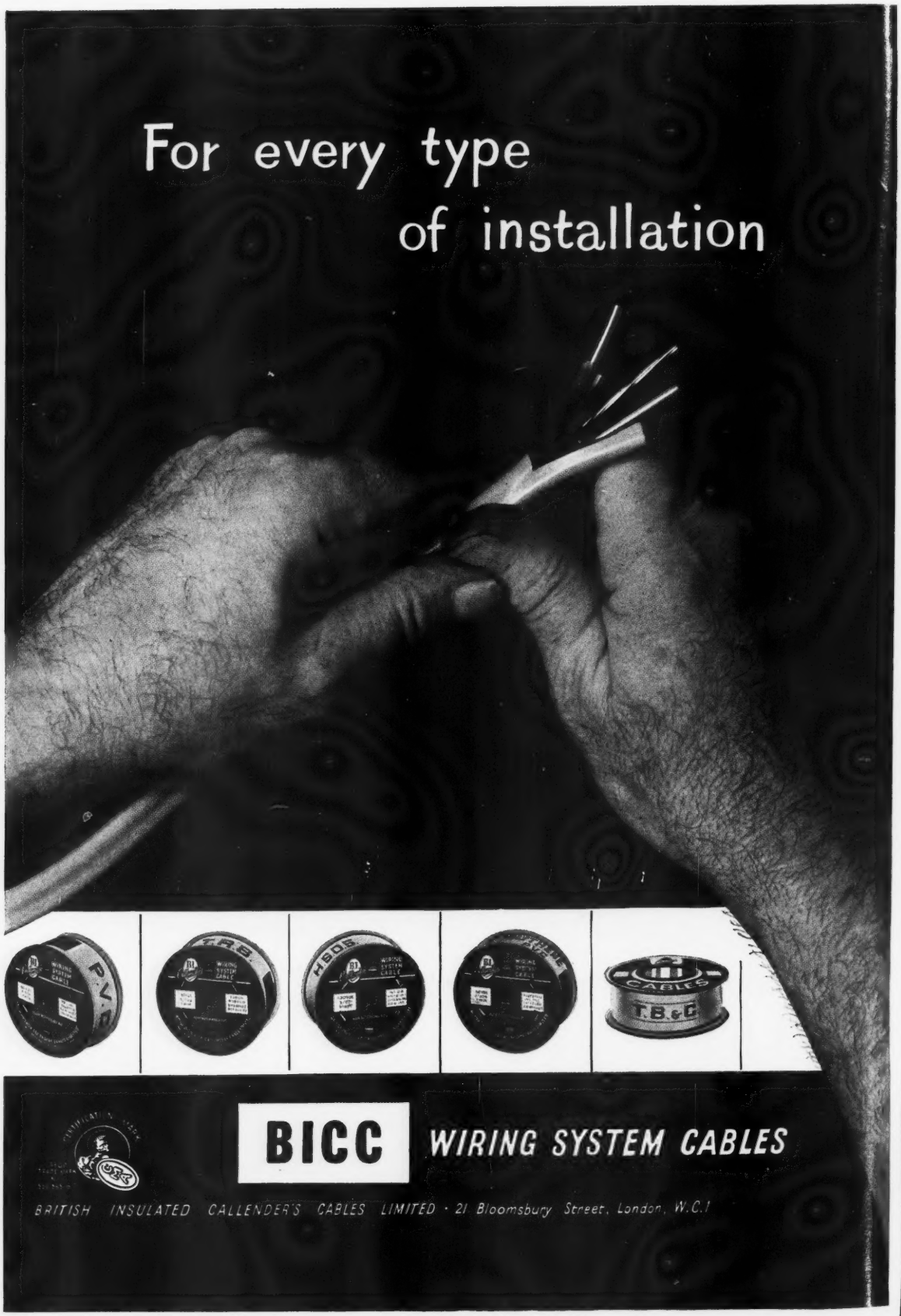

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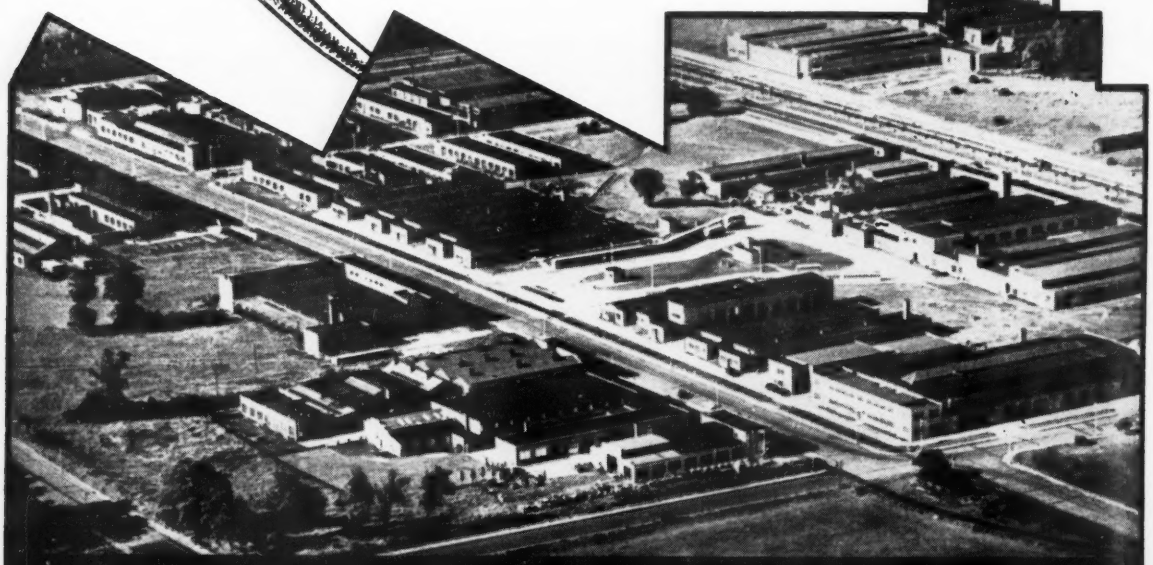

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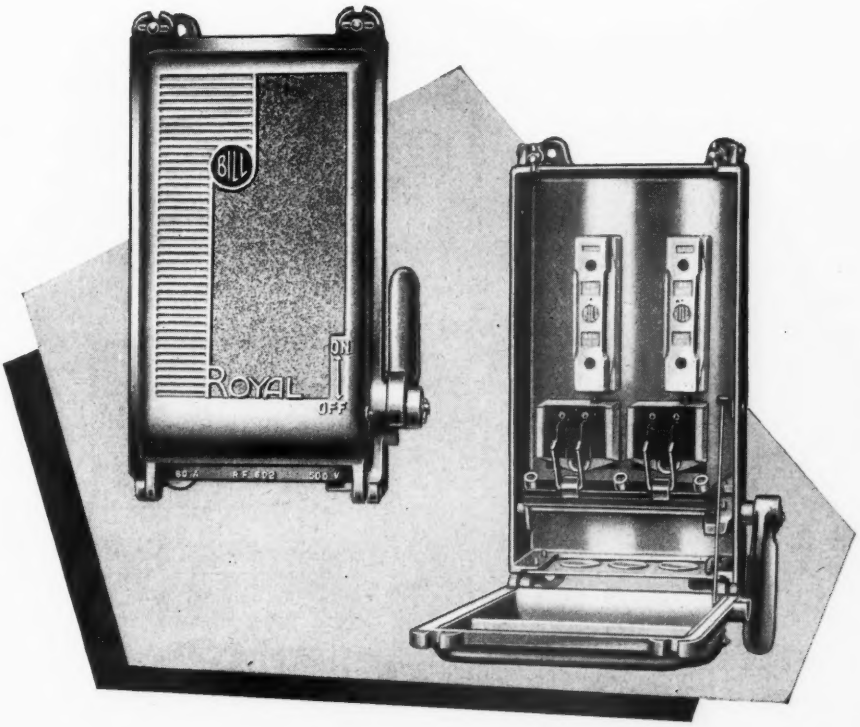

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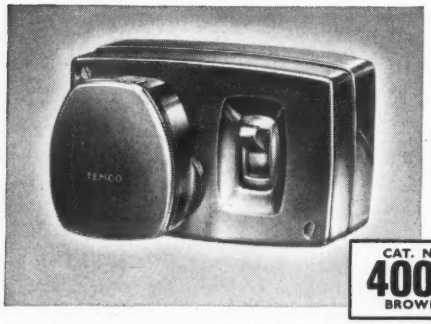

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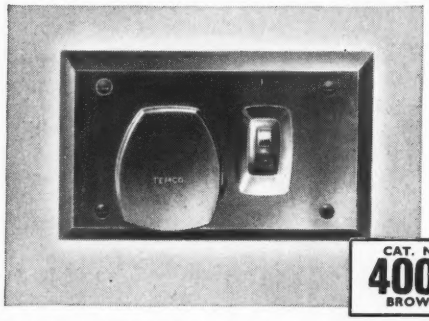

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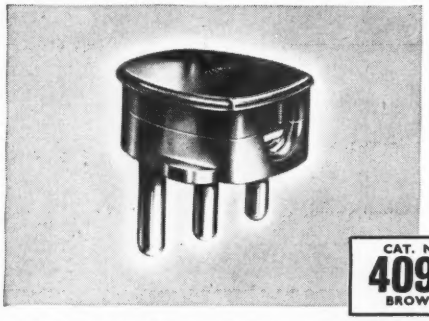

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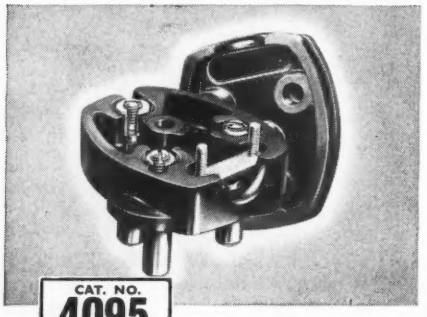

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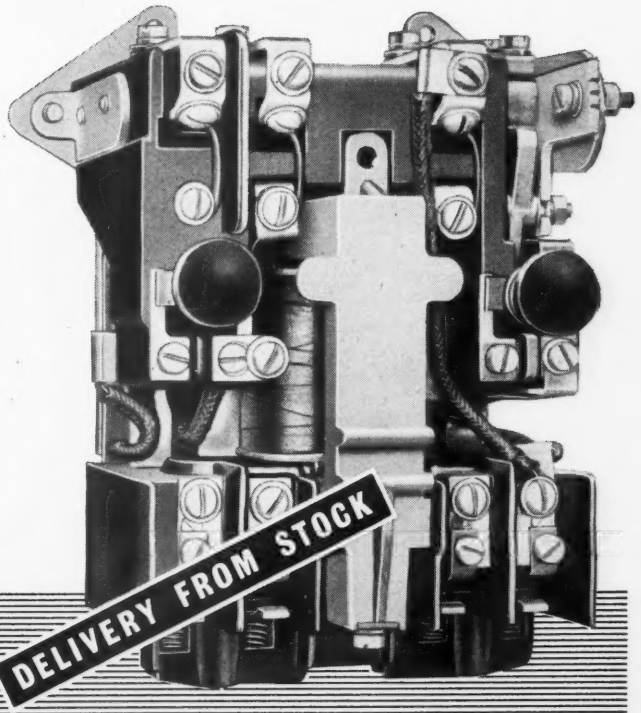

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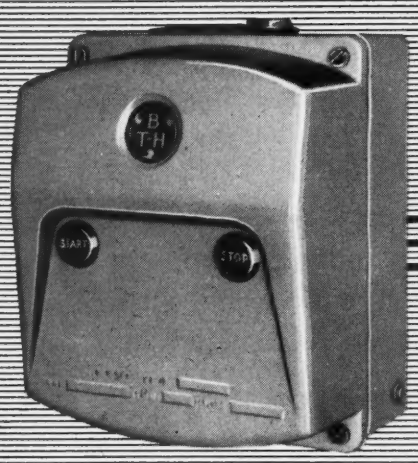

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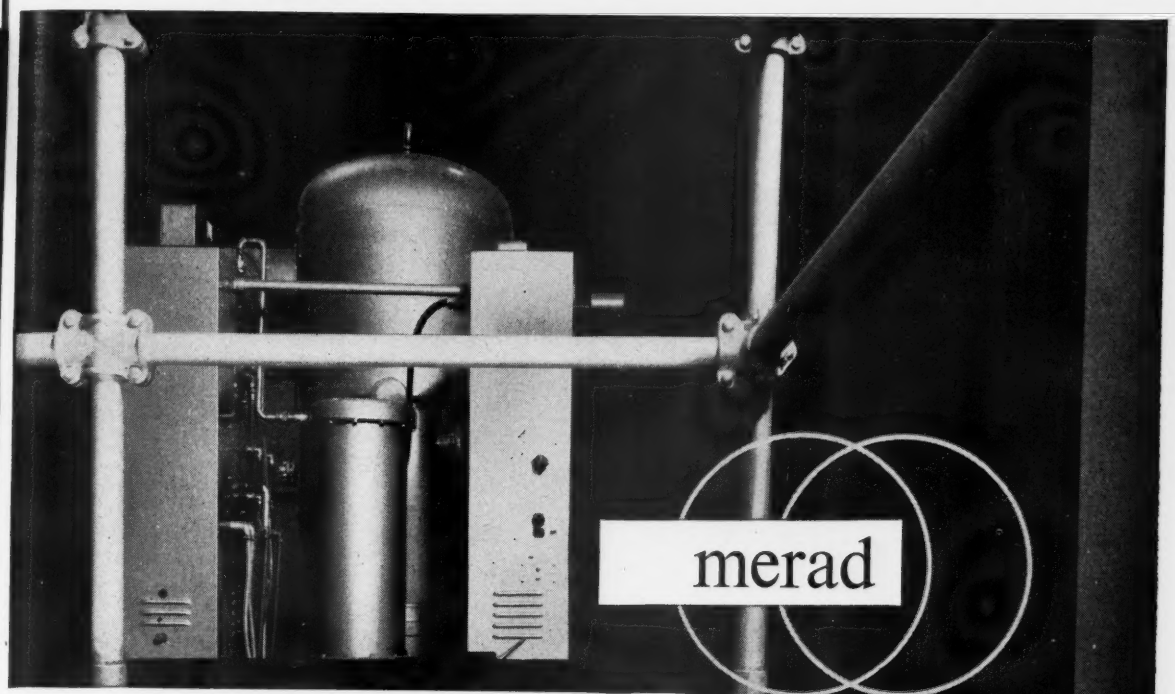
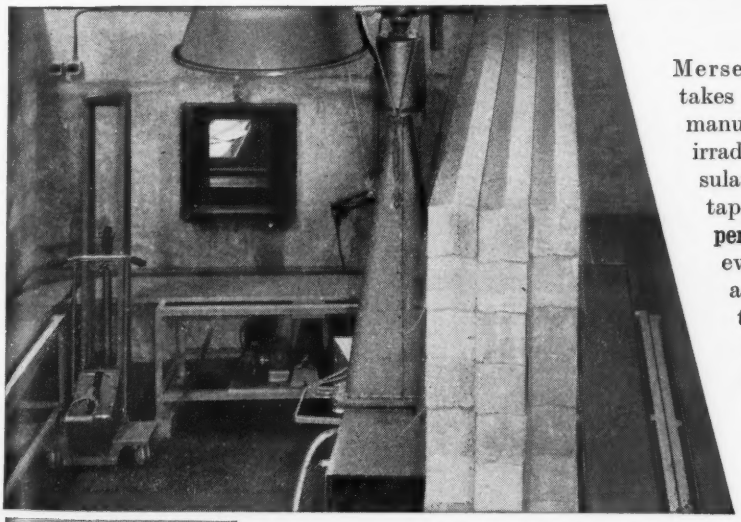


The first irradiated electrical products



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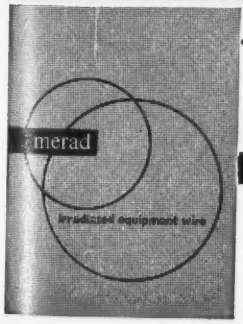

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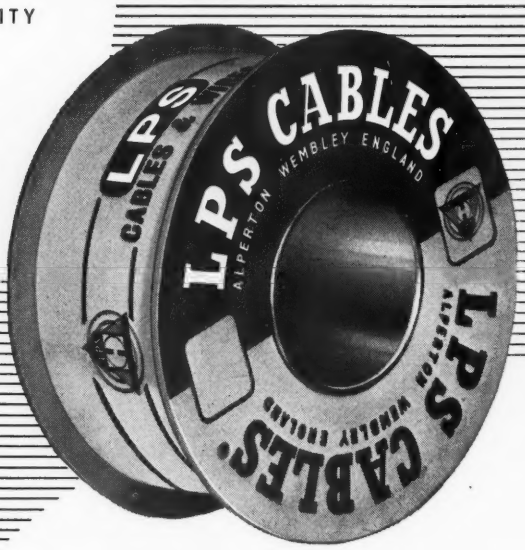

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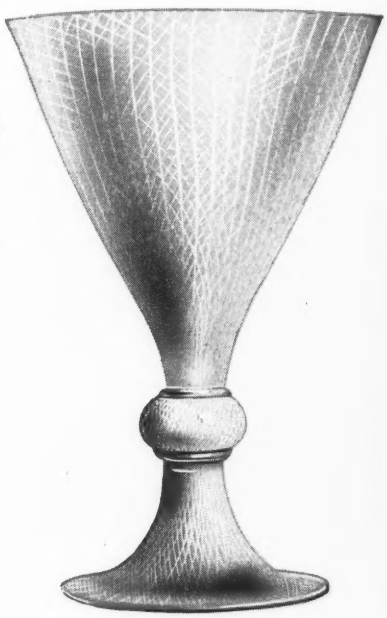

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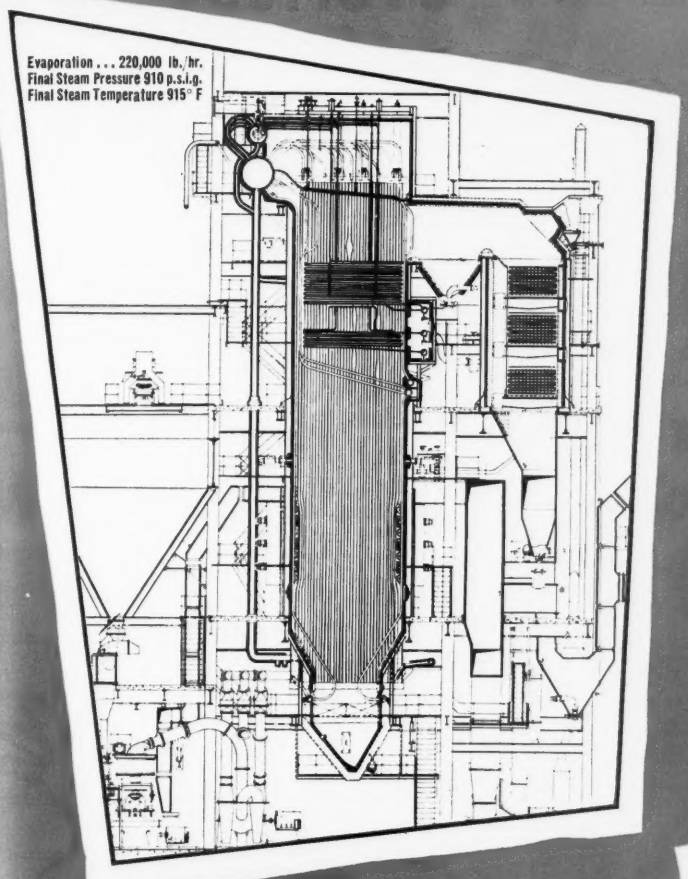

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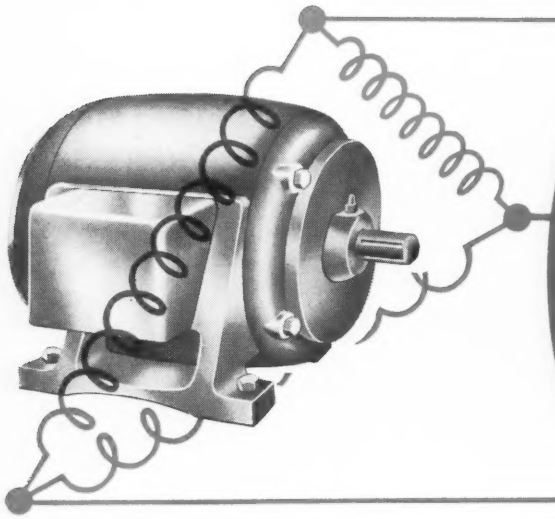

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PLUS—

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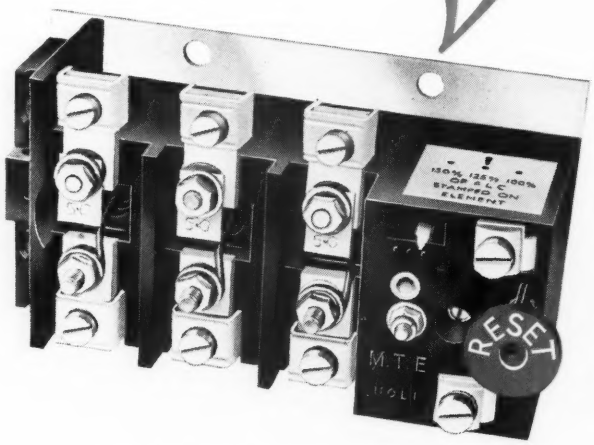

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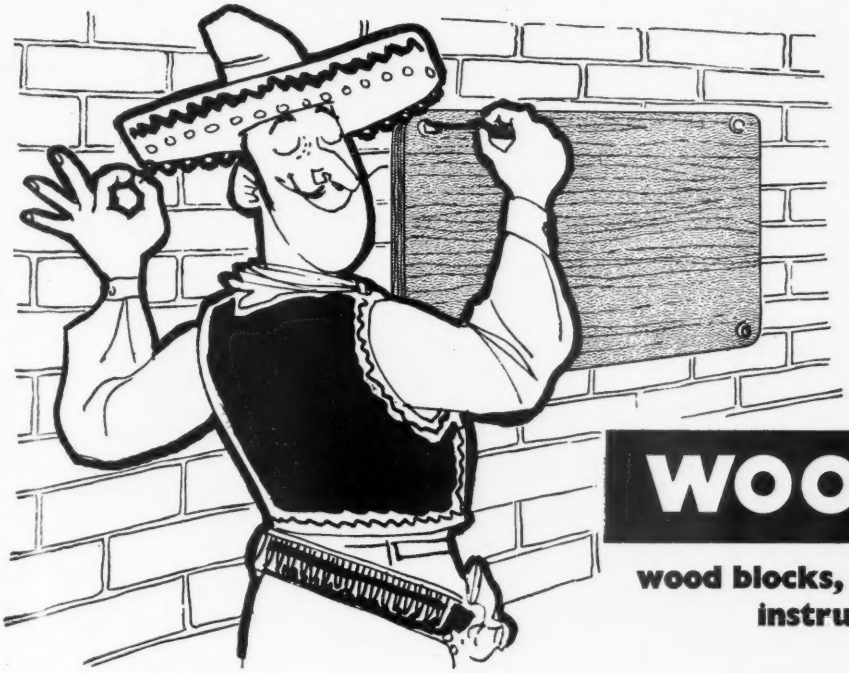

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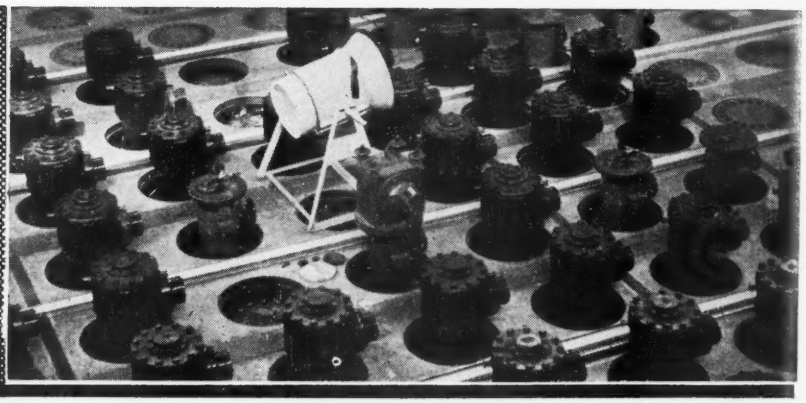

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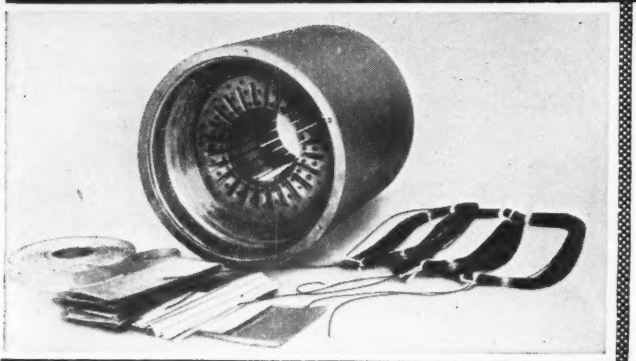
–AND SAFER. Silicone insulated dry-type transformers offer a safer alternative to oil-filled units.



One of the motors is shown before winding. The following silicone insulation components are employed:

CONDUCTOR WIRES – *Silicone-enamelled wire.*
SLOT LINERS – *Silicone-bonded mica backed with glasscloth.*
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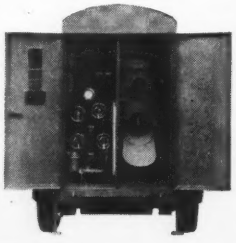

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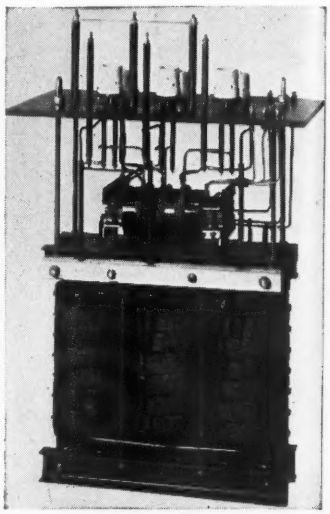

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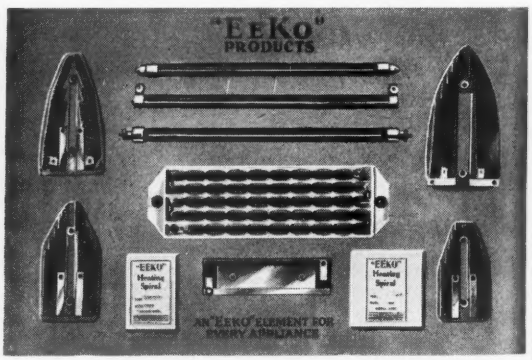

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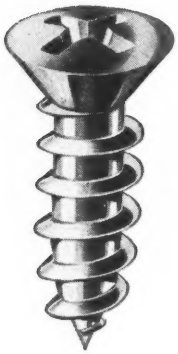
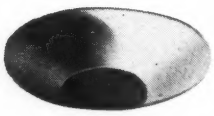
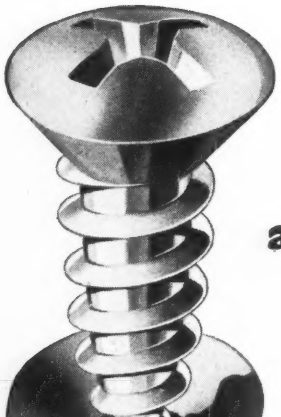


there is



a plain



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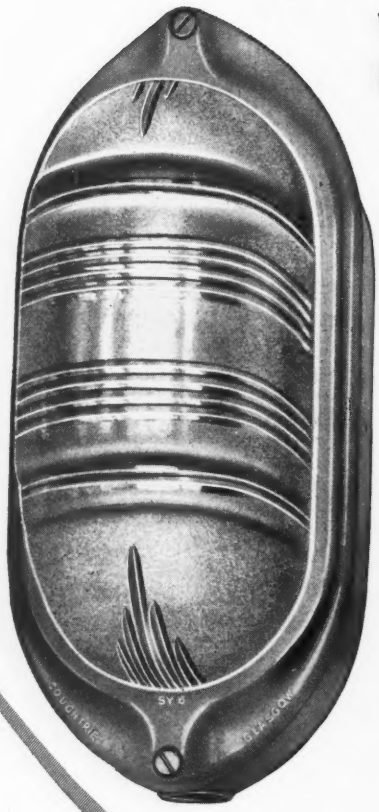

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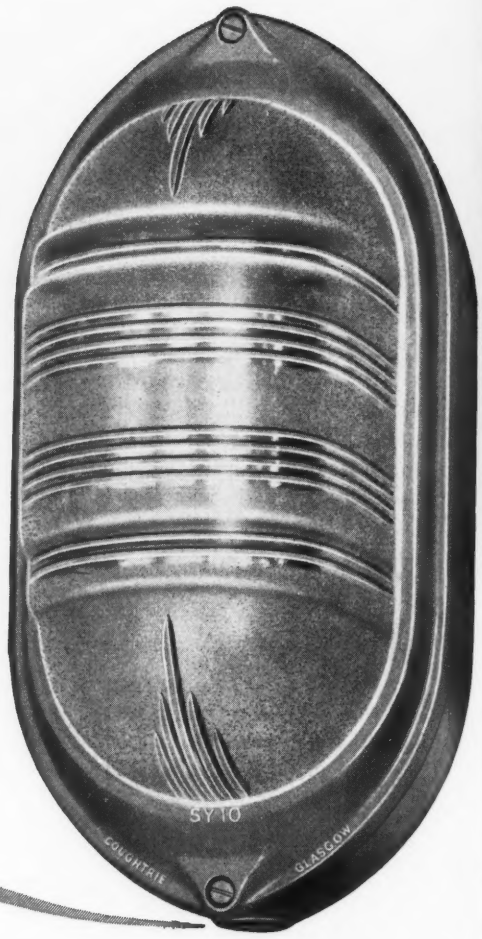

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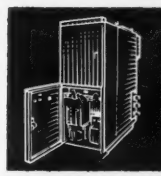

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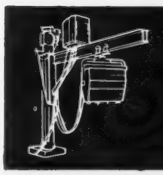

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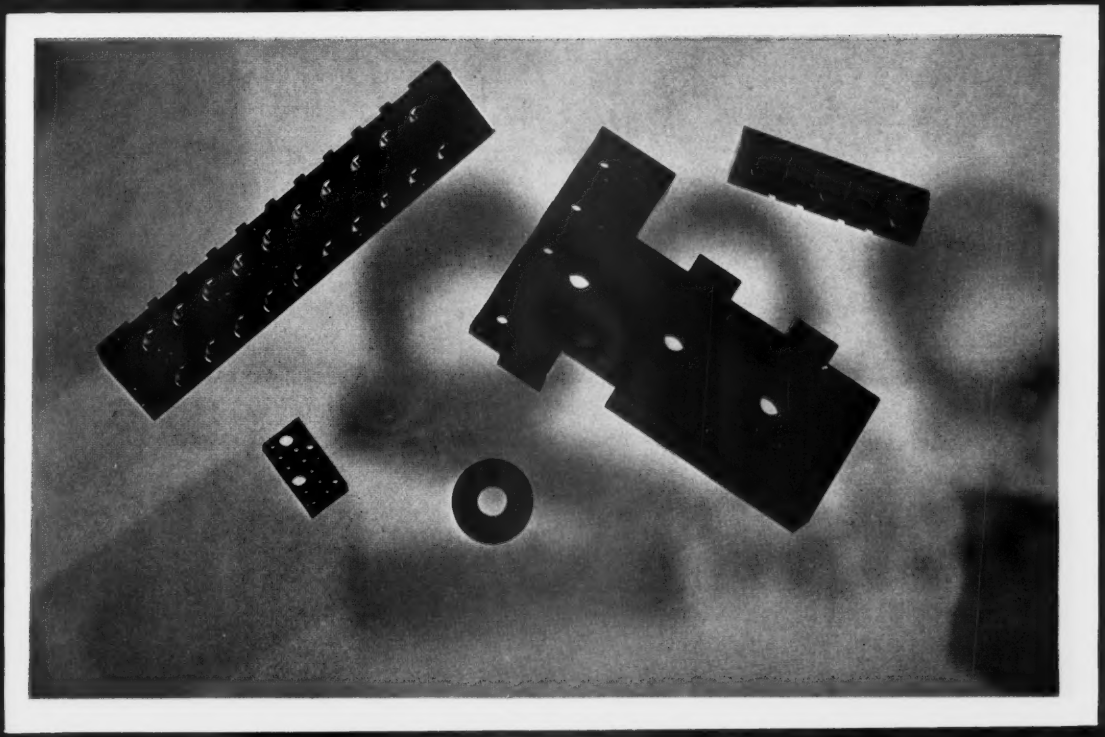

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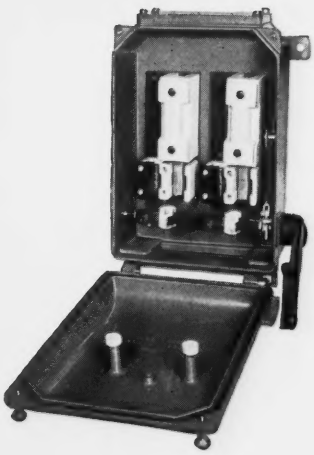

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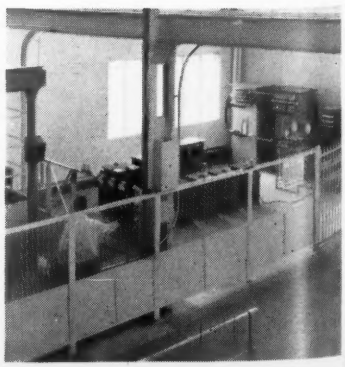

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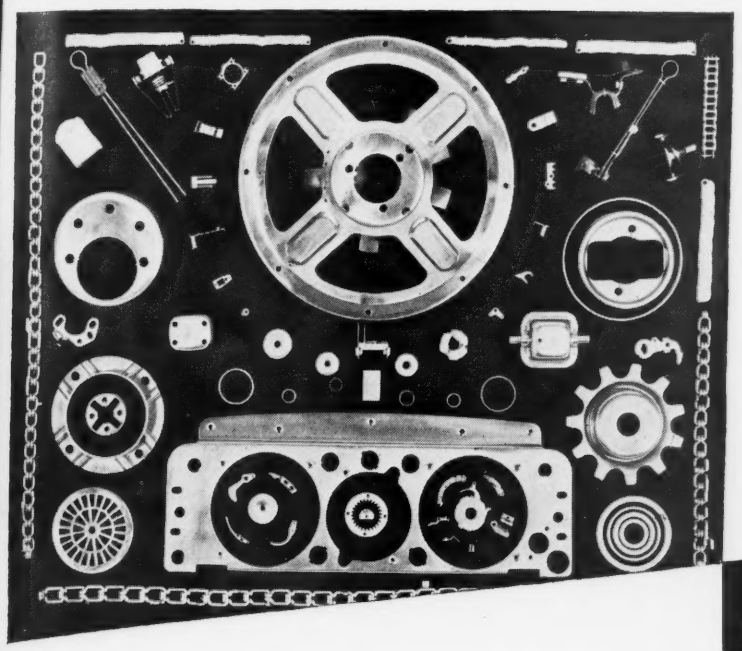

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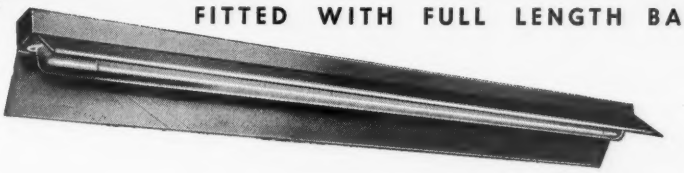

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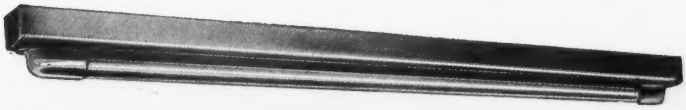

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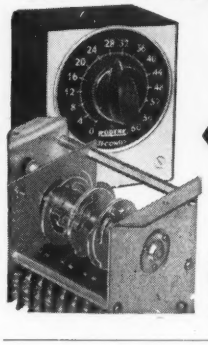

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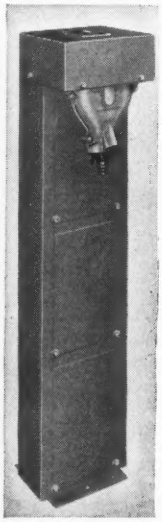

S.T.C. can therefore offer to economically minded managements the maximum return for the minimum investment.

in an all welded steel case which contains no gaskets likely to cause oil leakage. The adaptability of the system enables the units to be used for individual motor correction and for larger capacitors of up to 108 kVAr to be assembled from the units.

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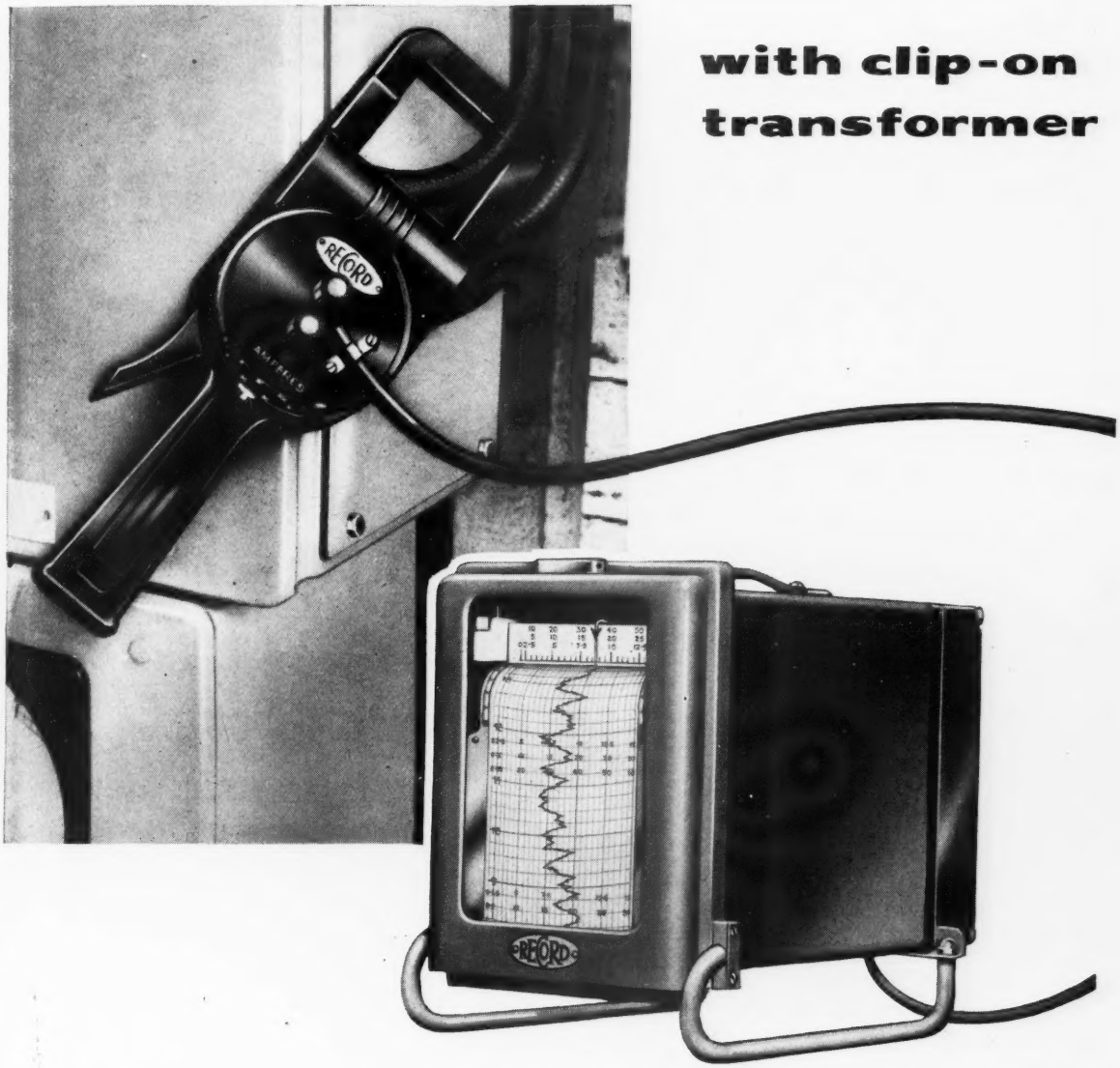

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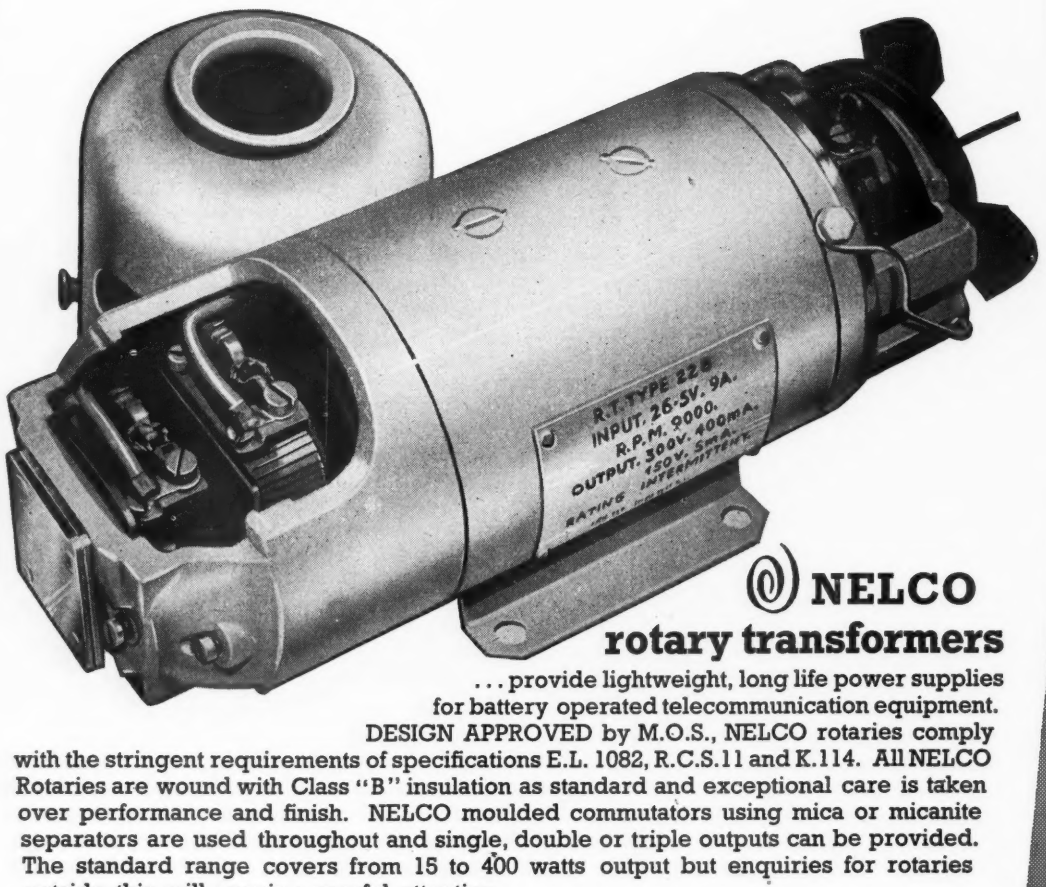

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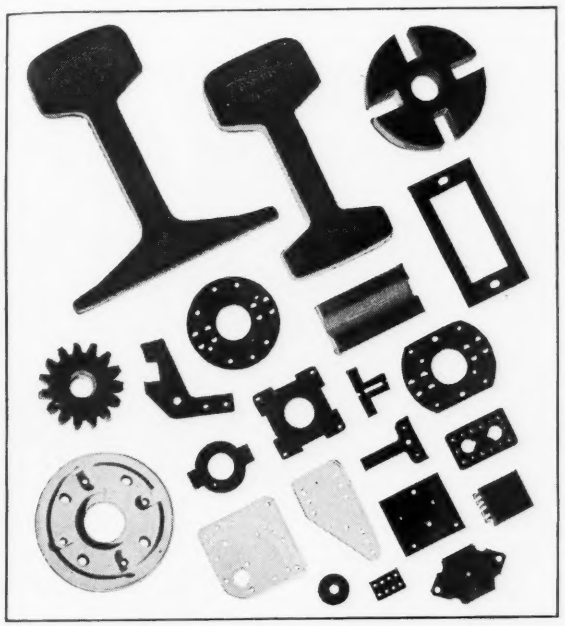

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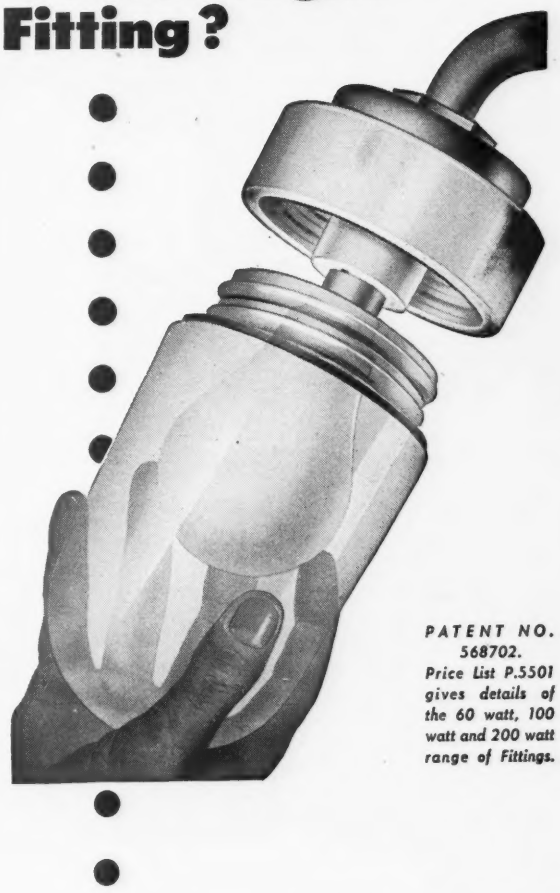

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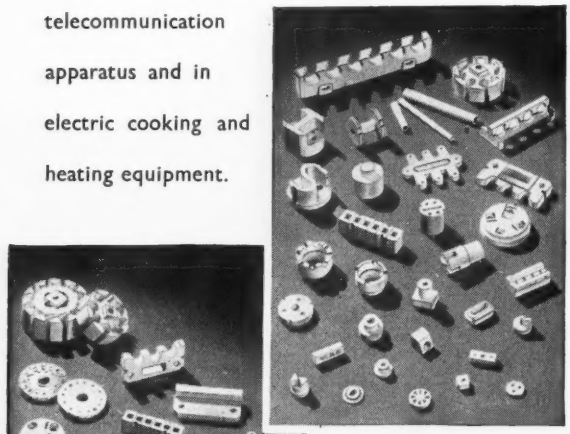

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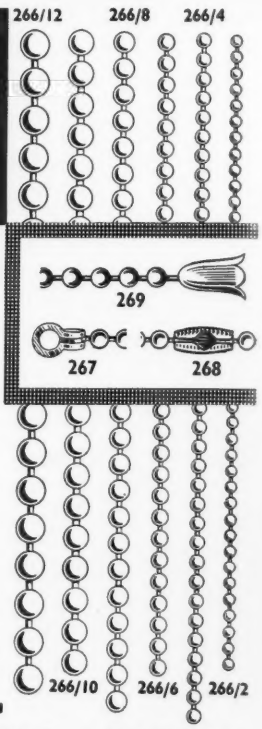

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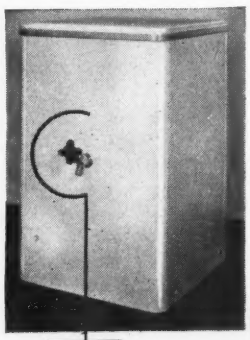

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Neoprene/Hypalon products are made in this country. For details of suppliers or any other information required please write to the sole distributors in the U.K.

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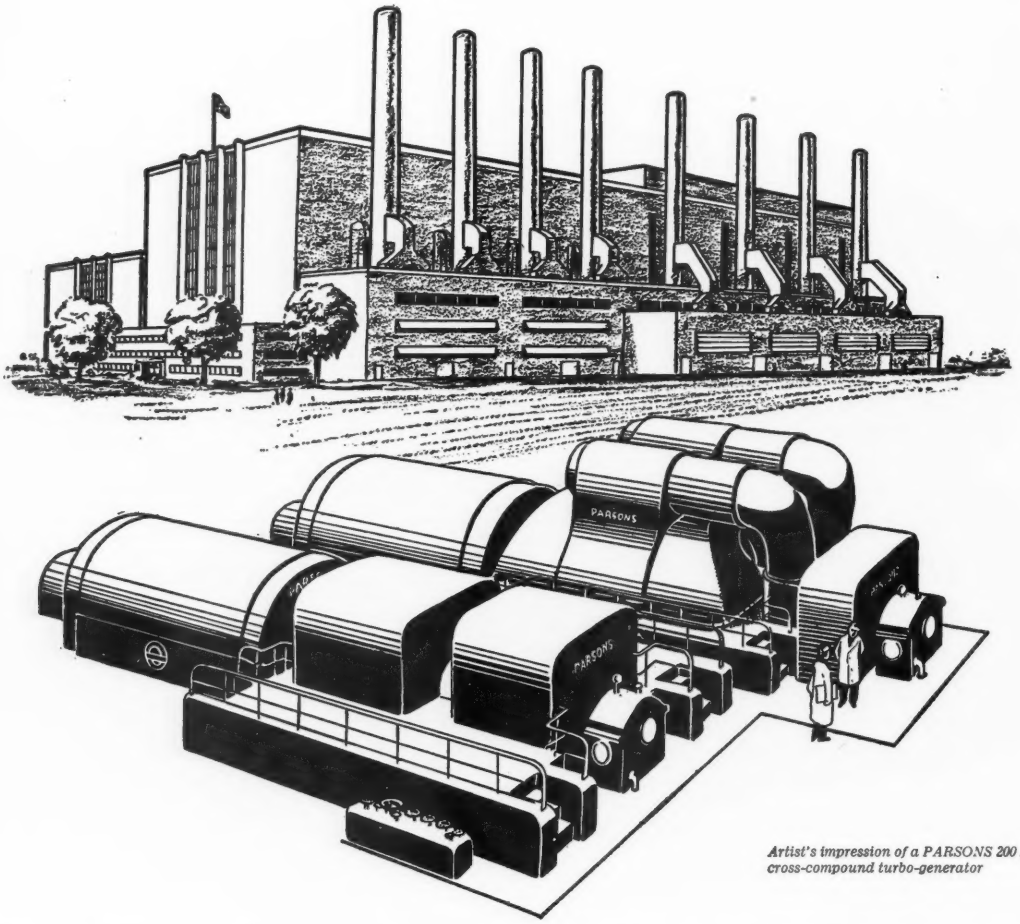
1,200,000 kW... and all PARSONS



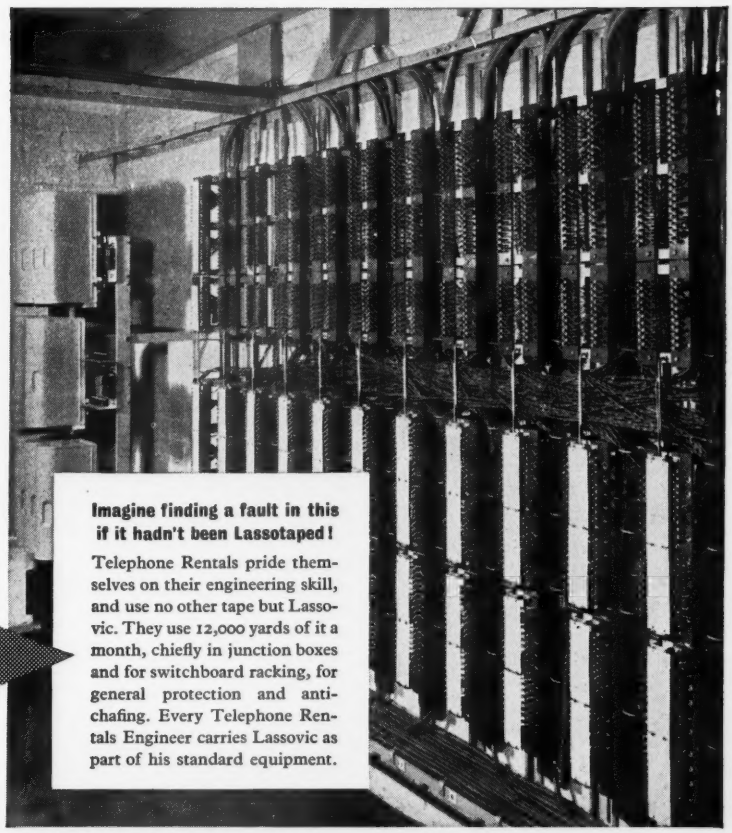
Artist's impression of a PARSONS 200 MW cross-compound turbo-generator

The Hydro Electric Power Commission of Ontario, Richard L. Hearn generating station at Toronto when fully extended will be the largest power station in the world with all turbo-generators from one manufacturer. The first four machines to be installed are Parsons 100 MW type, These are now being implemented by the addition of four 200 MW Parsons cross-compound sets raising the station output to 1,200,000 kW. On these later machines the H.P. lines will run at 3,600 r.p.m., and the L.P. lines at 1,800 r.p.m., a single generator developing 100 MW being coupled to each line . . . Steam conditions, 1,800 lb/ins.^{2} Temperature 1,000° F. Re heat temperature 1,000° F.

PARSONS turbo-generators

C. A. PARSONS & CO. LTD., HEATON WORKS, NEWCASTLE UPON TYNE, 6

This is why TELEPHONE RENTALS



Imagine finding a fault in this if it hadn't been Lassotaped!

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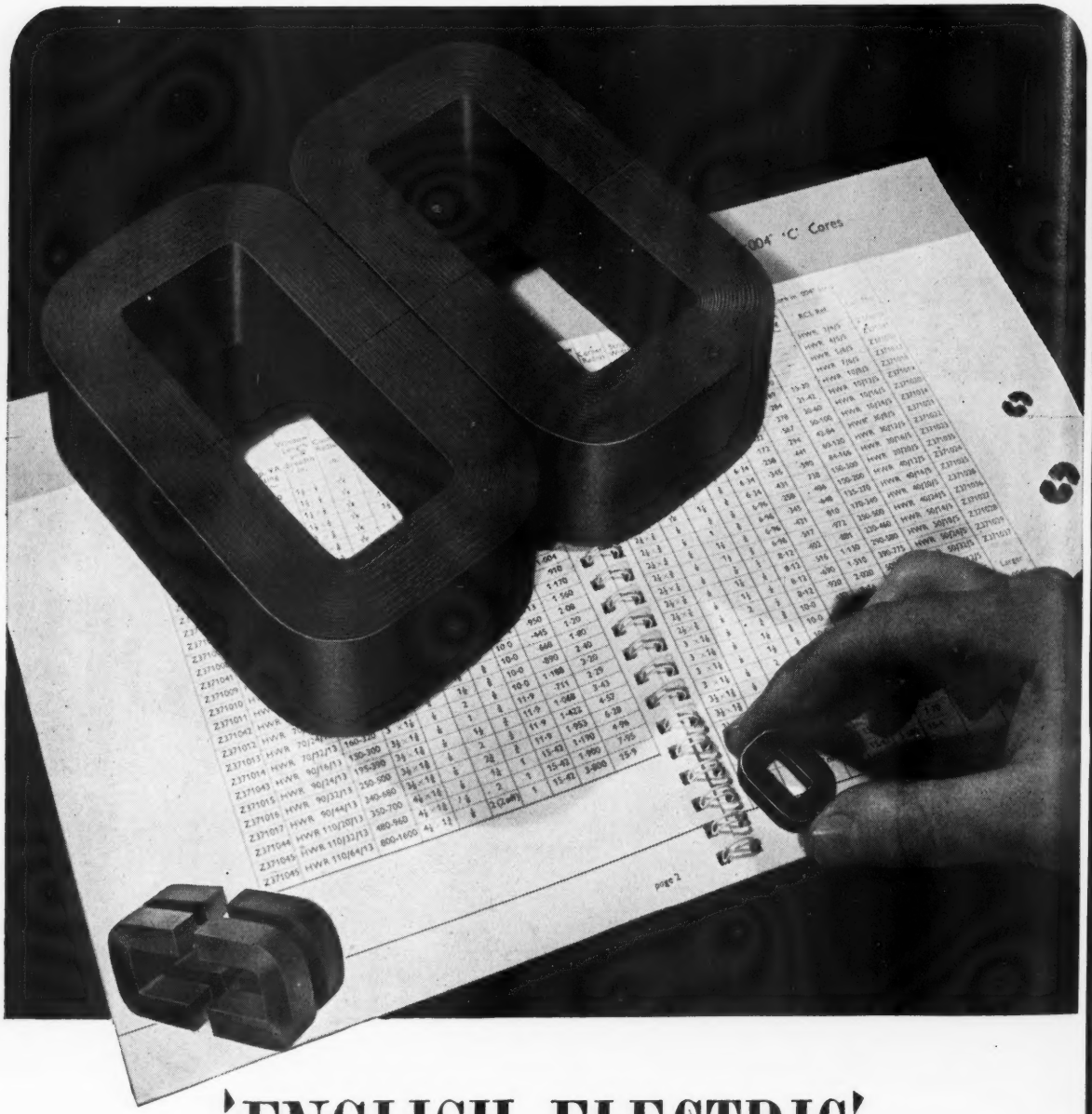

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Britain's leading manufacturers of 'C' Cores

'ENGLISH ELECTRIC' introduced 'C' Cores to Britain and established the Standard Inter-Service Range in conjunction with the Radio Components Standardisation Committee. The full RCS range of 'C' Cores and a comprehensive range of accessories are AVAILABLE FROM STOCK. *Enquiries for 'C' Cores should be made to The* ENGLISH ELECTRIC *Company Limited, Transformer Sales & Contracts Section, East Lancashire Road, Liverpool, 10. Telephone AINtree 3641.*

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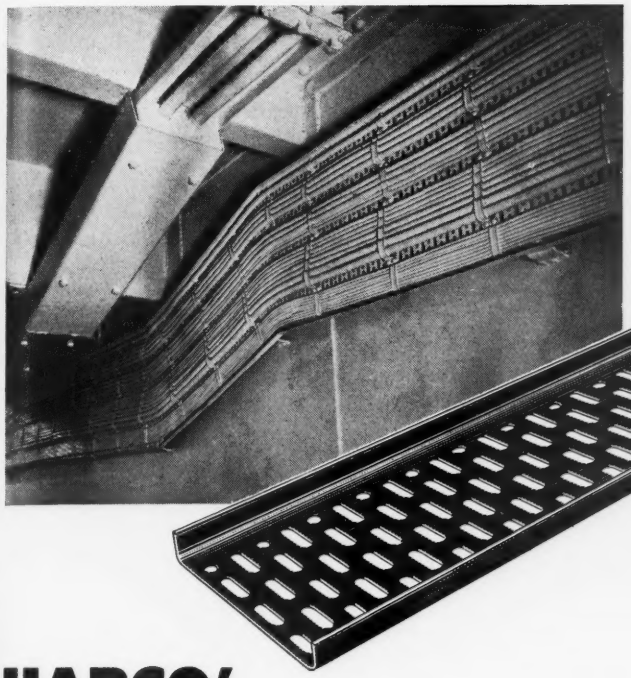

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FOR CLOSE CONTROL OF SPACE HEATING

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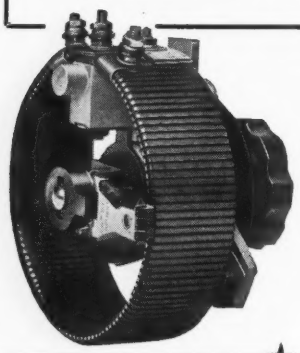

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100 watts
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An extremely robust rheostat with a unique metal cored former (patent appd. for)

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S42

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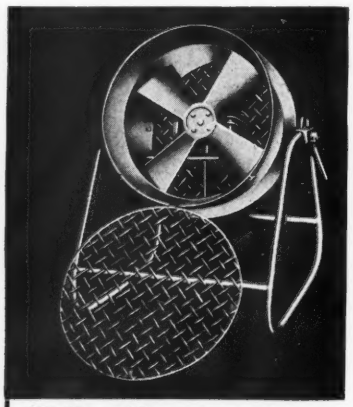

15", 18" and 24" diameters
PRICES REDUCED *Prices of Airscrew Man Coolers are now reduced. The reductions range from 10% for the 3-phase 15" model to 24% for the 18" single-phase fan.*

When any spot's too hot for the operatives to work in cool, efficient comfort, bring in the Airscrew Man Cooler. It's rugged, safe and easily adjustable so that air can be directed right where it's wanted.

Airscrew Man Coolers have so extensive a cooling range that ventilation is also provided for workers in adjacent areas. These fans are also useful for removing fumes. They are robust, easily handled and have convenient lifting shackles. Apart from being inexpensive to buy, running and maintenance costs are negligible.

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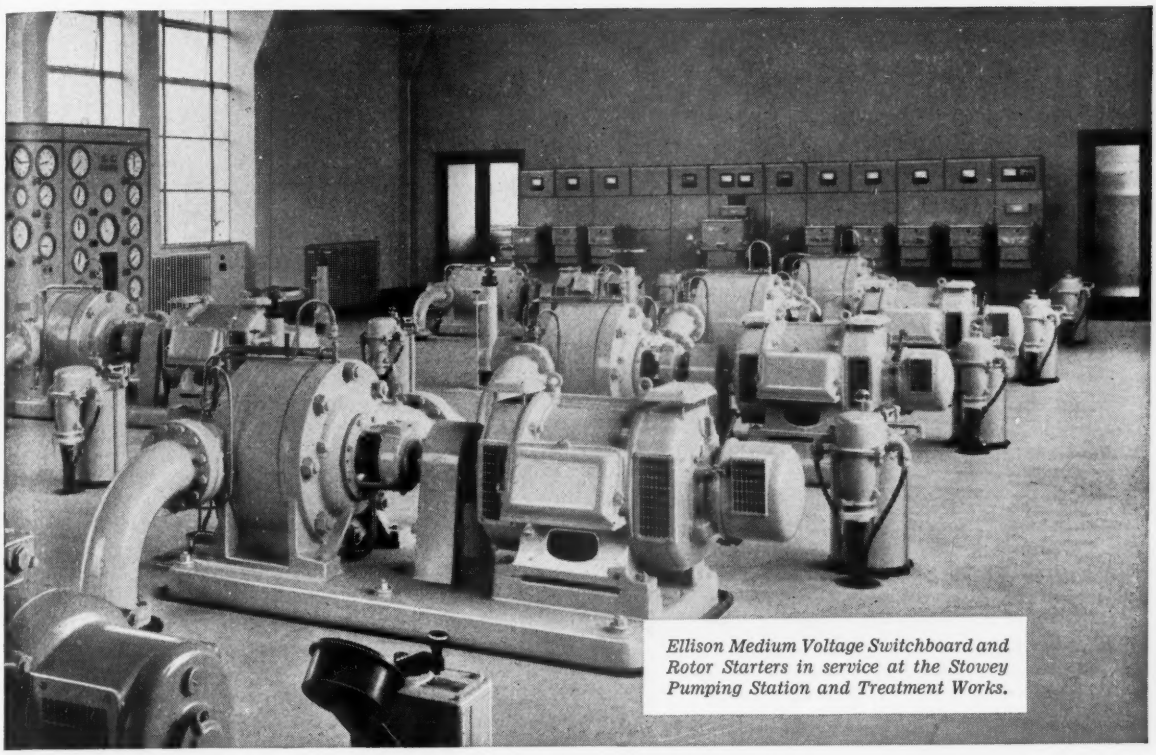

Ellison Medium Voltage Switchboard and Rotor Starters in service at the Stowey Pumping Station and Treatment Works.

Bristol relies on ELLISON for

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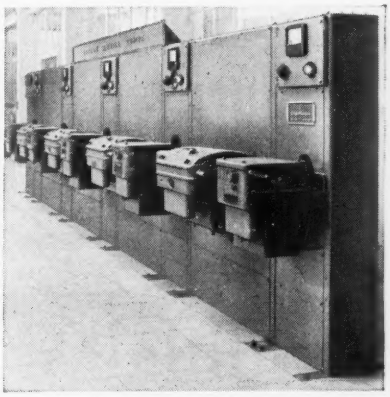
AND VICTORIA, BLAGDON, CHEDDAR AND BARROW PUMPING STATIONS

Ellison switchgear and starters have been chosen for part of the Chew Valley Lake Reservoir Scheme and major pumping stations because of their proven performance in service. Reliability is the hallmark of Ellison switchgear. It is the result of over half a century's experience and of painstaking care in design, research, manufacture and testing.



An Ellison Medium Voltage Korndorfer Starter Switchboard in service at the Chew Stoke Pumping Station.

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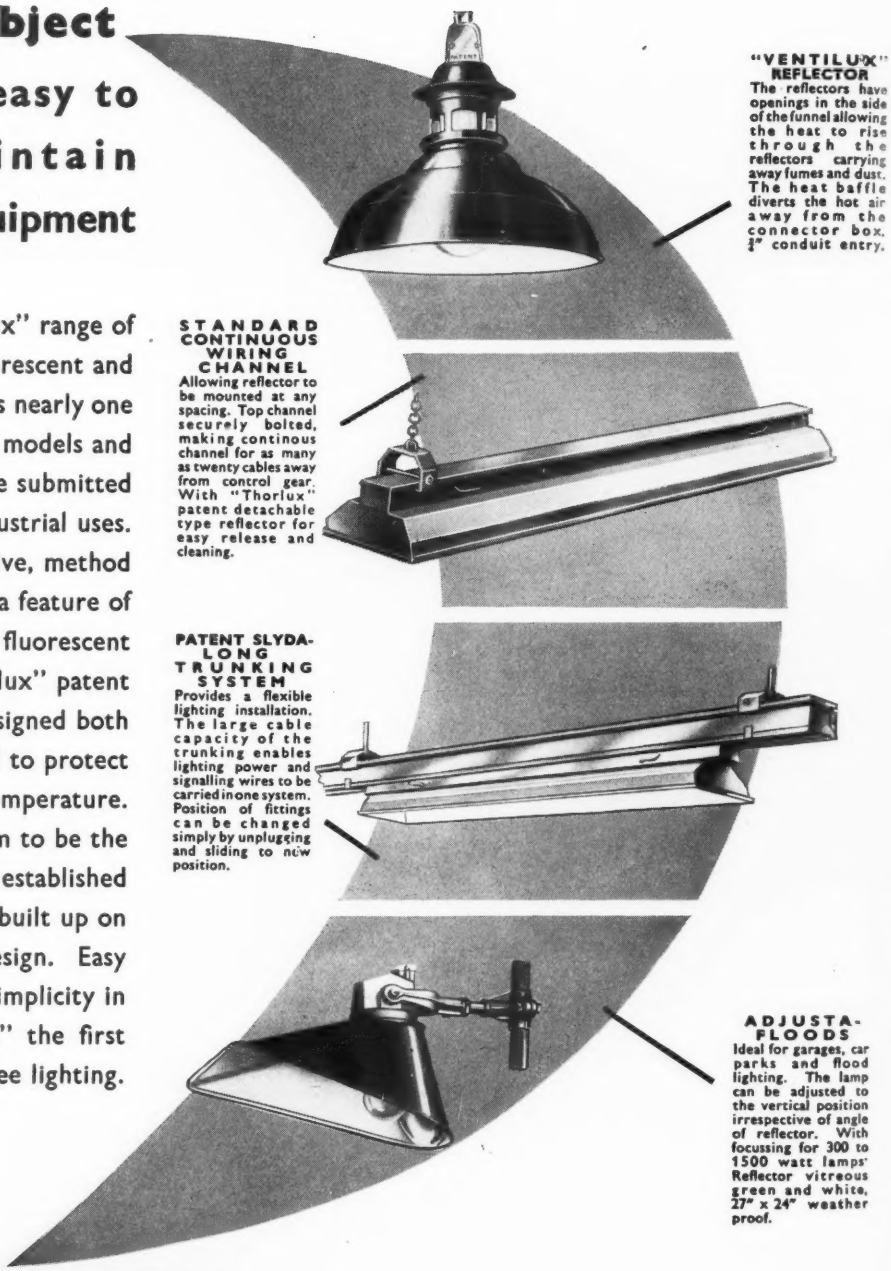
Continuing a Tradition

786

throwing light on the subject – of easy to maintain lighting equipment

The "Thorlux" range of reflectors for fluorescent and tungsten lamps covers nearly one hundred standard models and special designs can be submitted for all industrial uses. The simple, yet effective, method of detaching is a feature of both tungsten and fluorescent fittings. The "Thorlux" patent wiring box is designed both for easy wiring and to protect the cables from high temperature. We do not claim to be the cheapest but to have established a reputation built up on quality and design. Easy maintenance and simplicity in use make "Thorlux" the first name for trouble free lighting.



"VENTILUX" REFLECTOR
The reflectors have openings in the side of the funnel allowing the heat to rise through the reflectors carrying away fumes and dust. The heat baffle diverts the hot air away from the connector box. ¾" conduit entry.

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Allowing reflector to be mounted at any spacing. Top channel securely bolted, making continous channel for as many as twenty cables away from control gear. With "Thorlux" patent detachable type reflector for easy release and cleaning.

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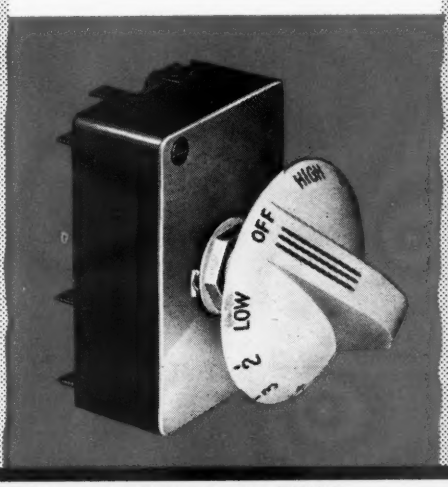

. . . WITH THE INTRODUCTION OF THE *Superswitch*

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Like all Satchwell products the "Superswitch" is another first-class instrument made by The Rheostatic Co. Ltd., and has, among many others, the following advantages :

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An unlimited number of settings—any heat from 8% to 100%.

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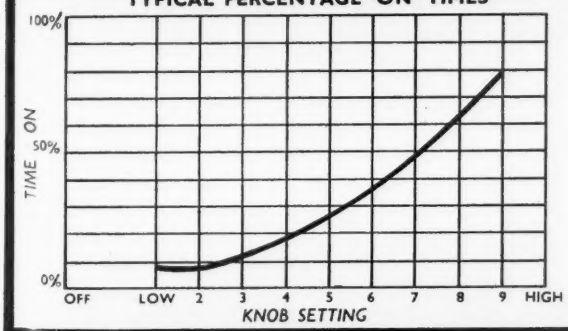
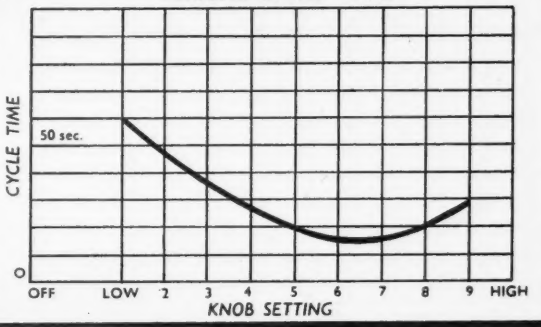


TYPICAL CYCLE TIMES



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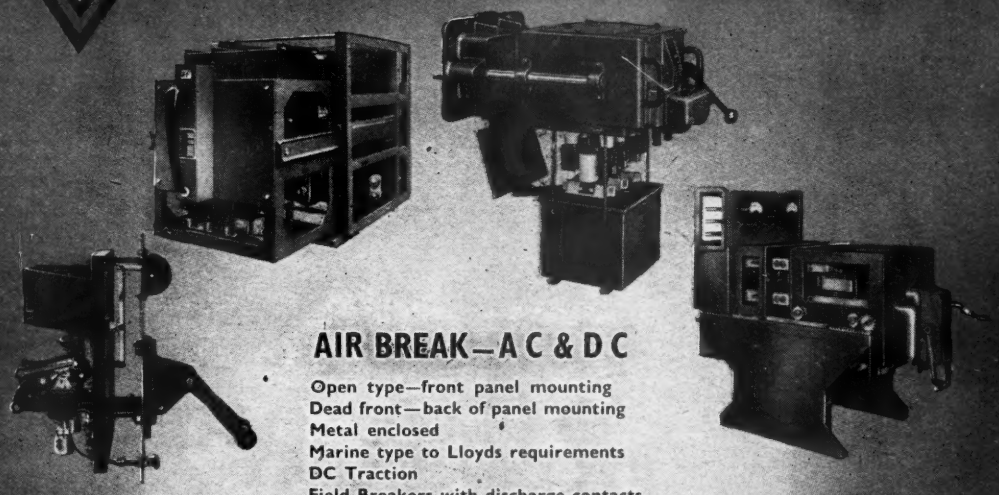

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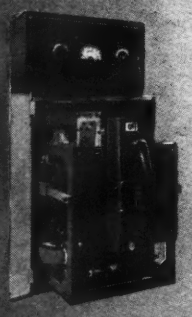

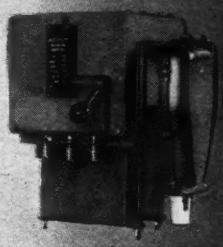

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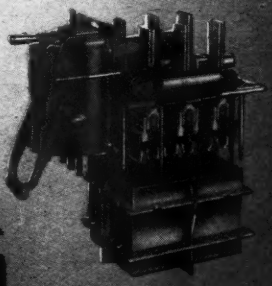

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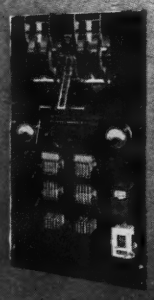

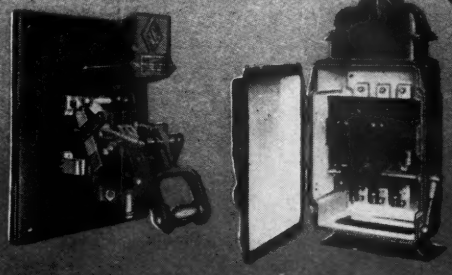

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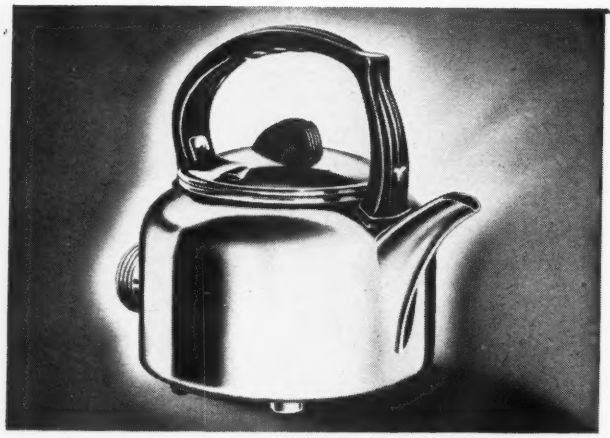

Revo design is the housewife's choice! Handsome is as handsome does! Look closely at both of these models—you'll find them every bit as good as their eye-catching modern lines suggest.

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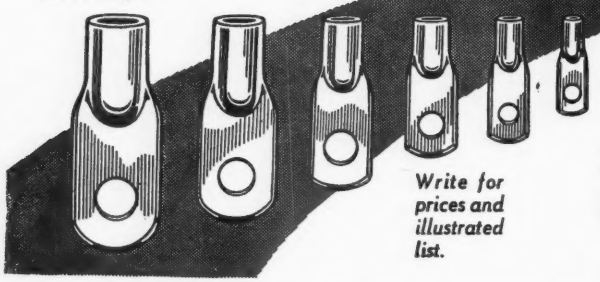

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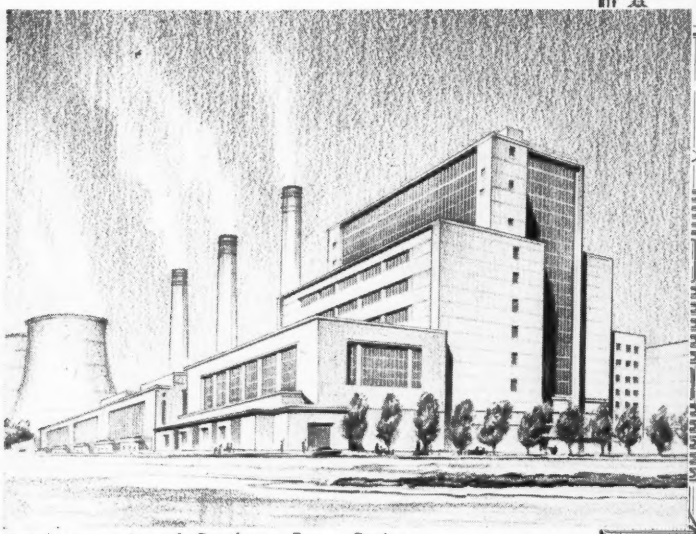
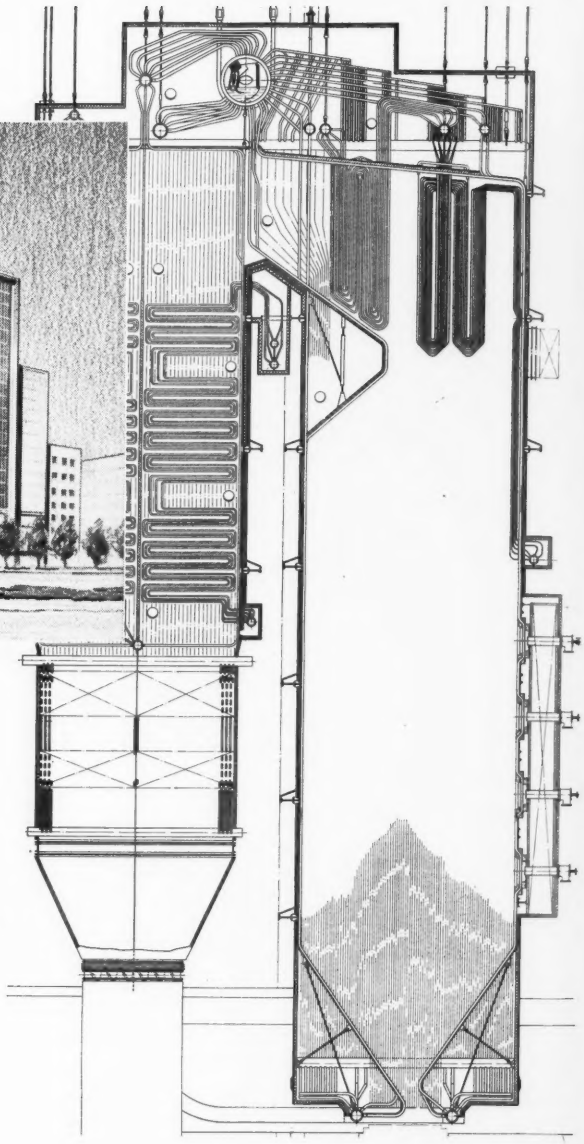


Artist's impression of Staythorpe Power Station.



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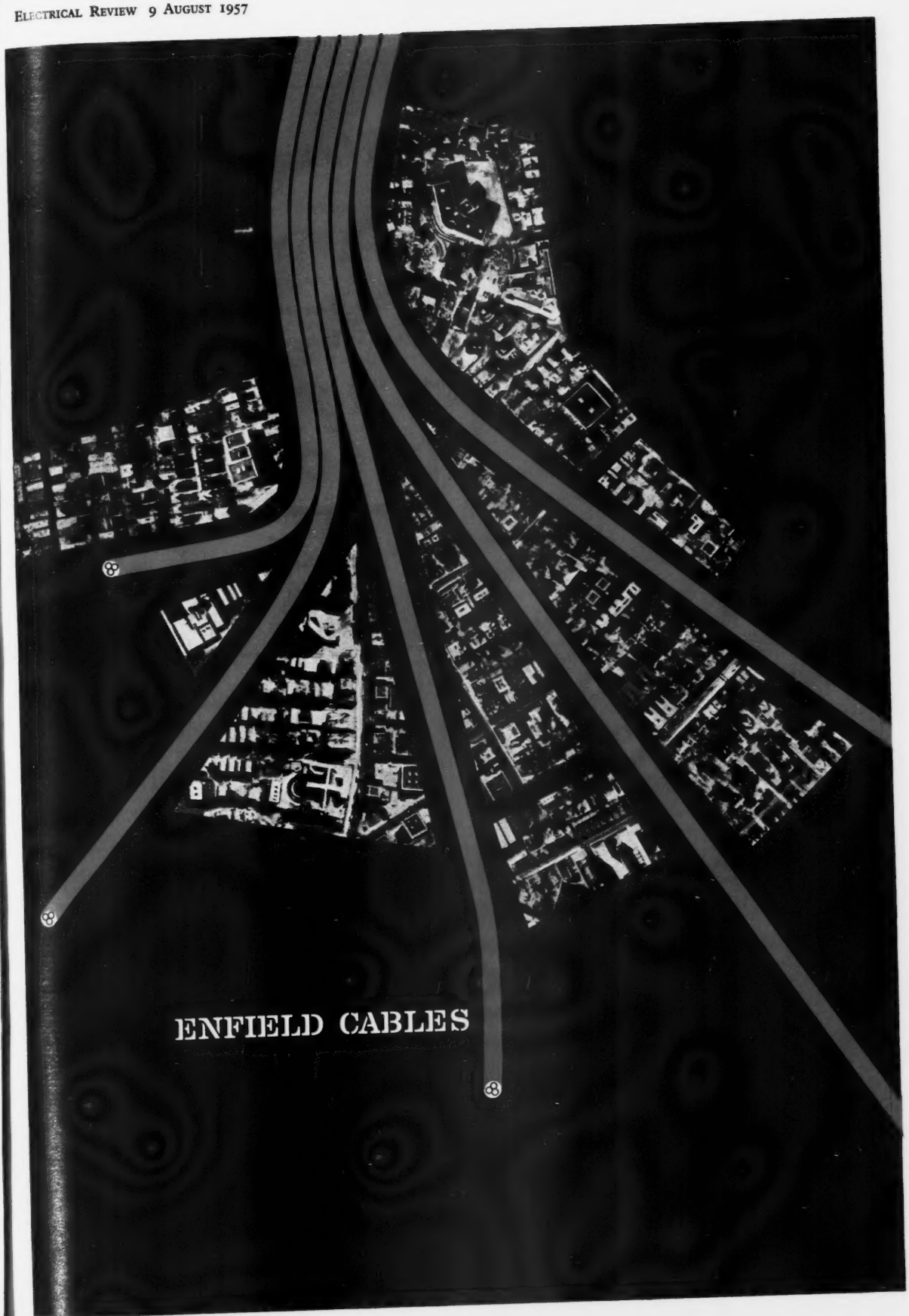
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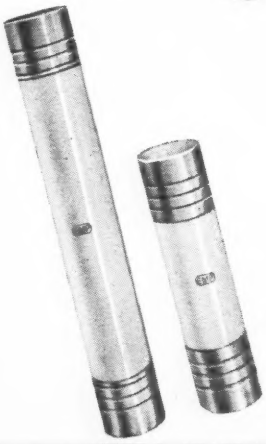

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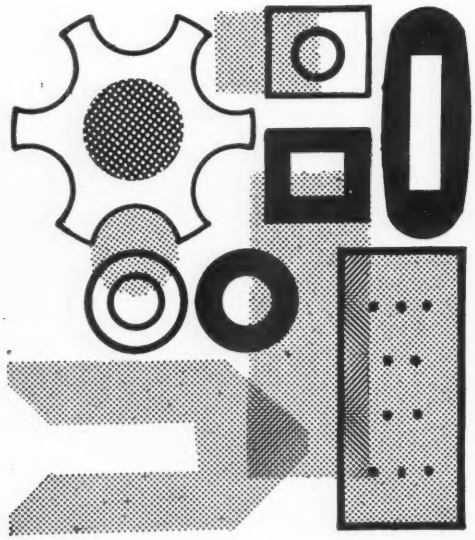

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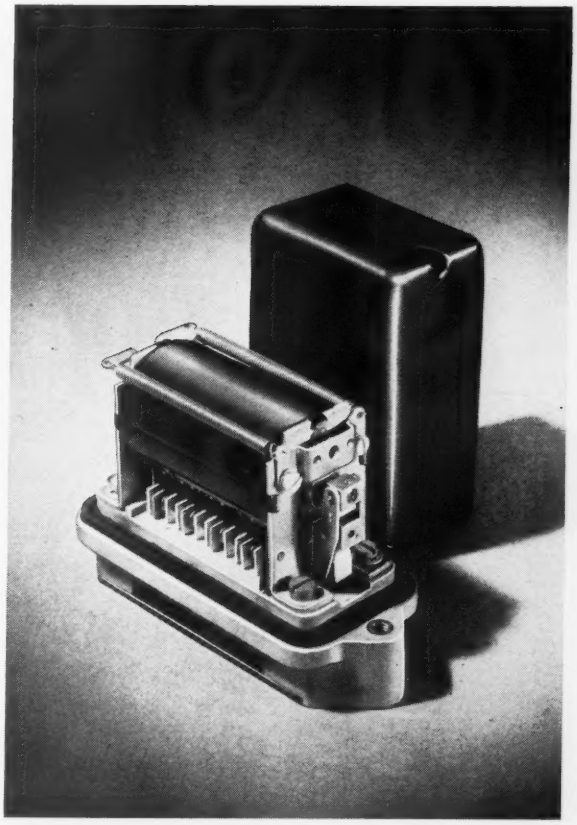

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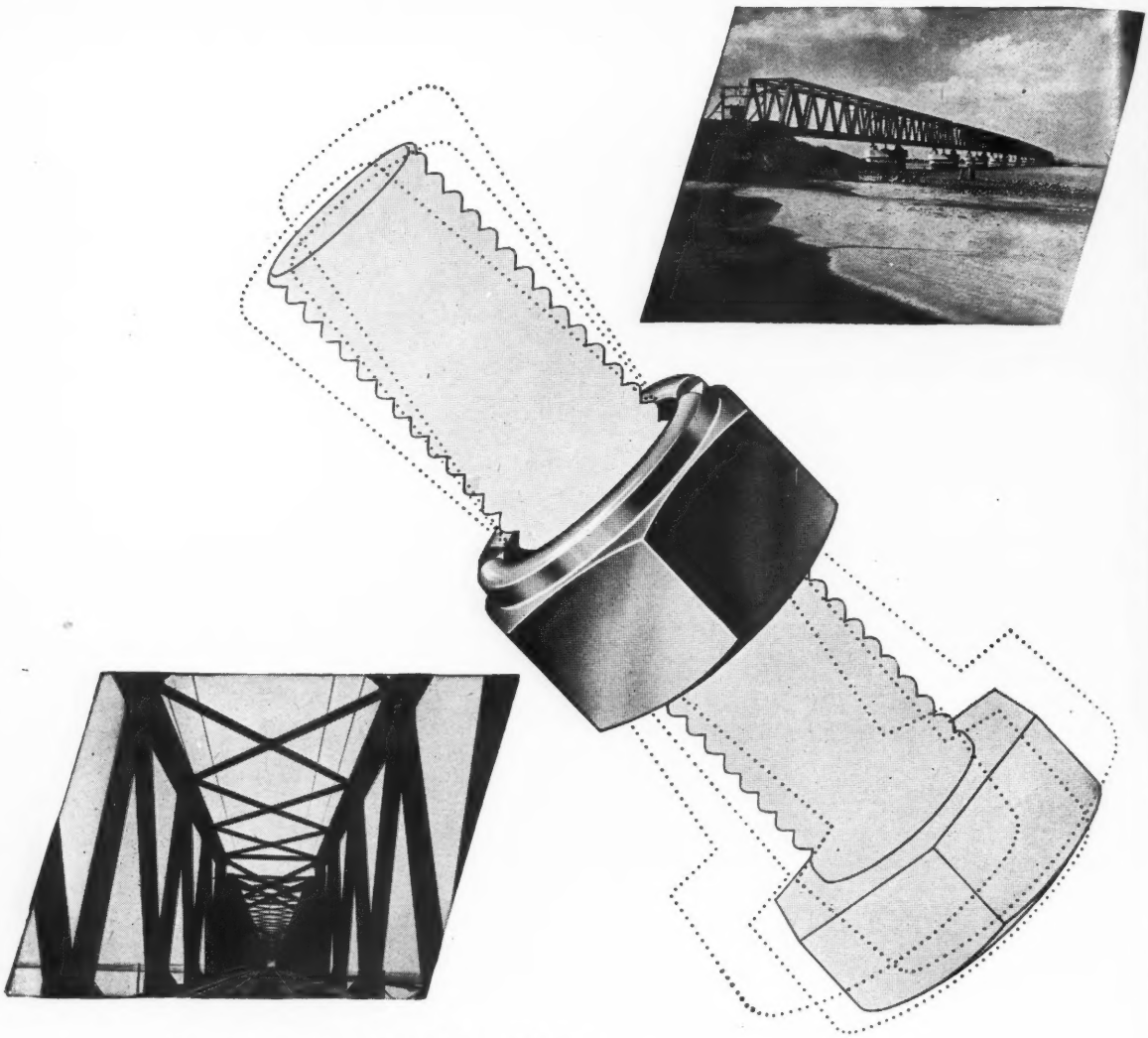

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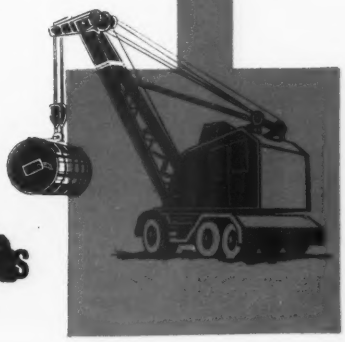

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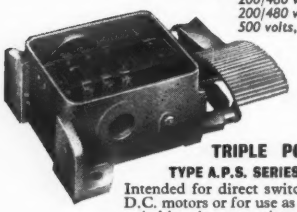

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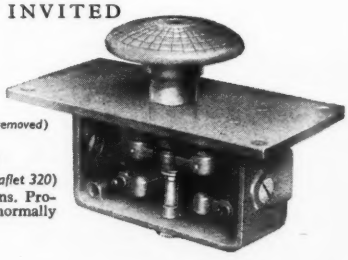

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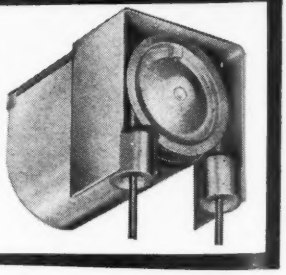

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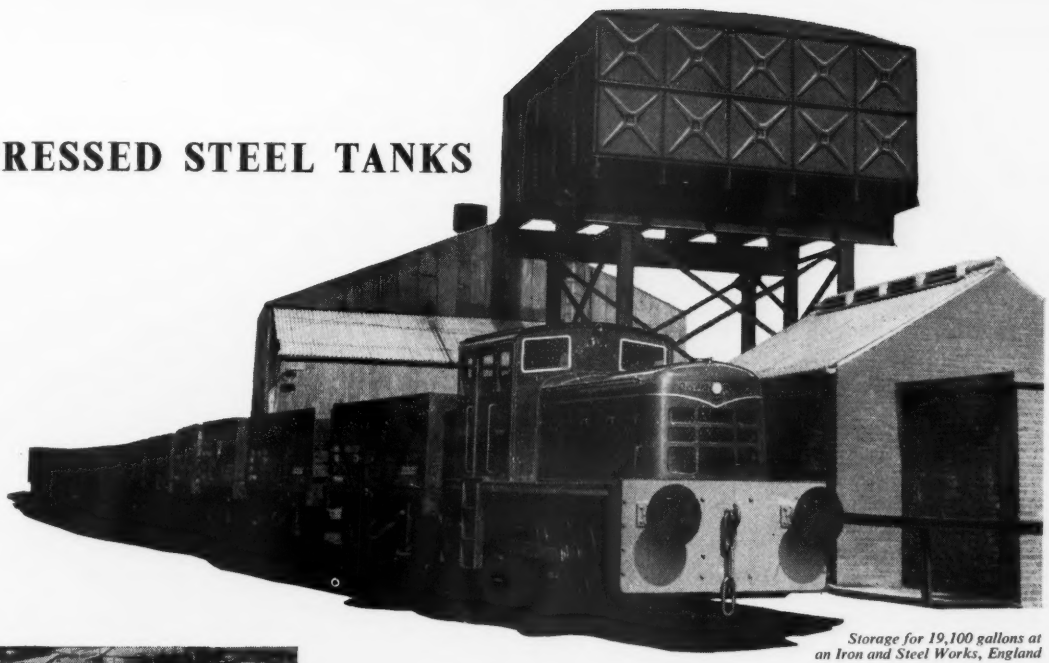
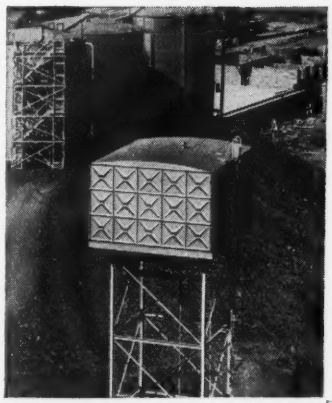


Storage for 19,100 gallons at an Iron and Steel Works, England



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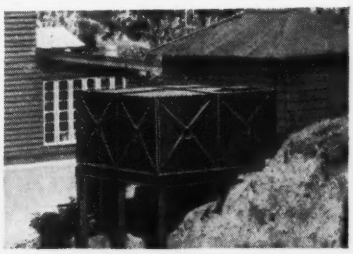

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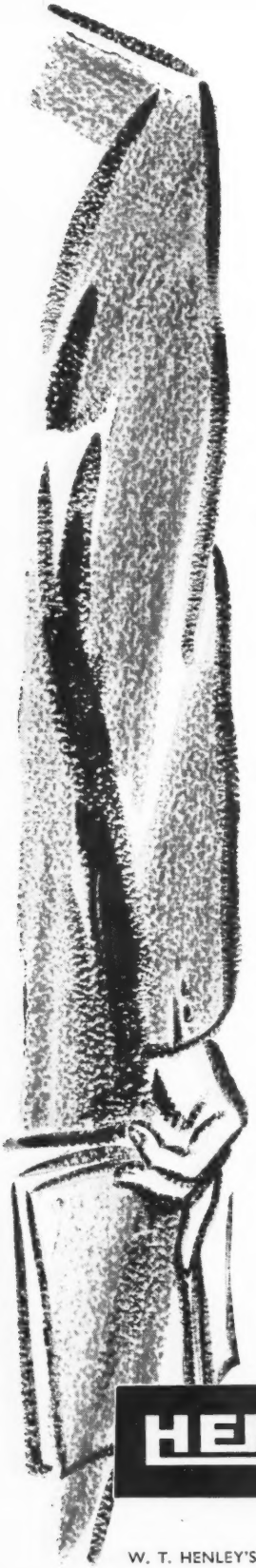

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Son: *What . . . .*

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9 AUGUST
1957

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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VOLUME 161 NUMBER 6 ✧ *Eighty-Fifth Year of Publication* ✧ FRIDAY PRICE 1s 6d

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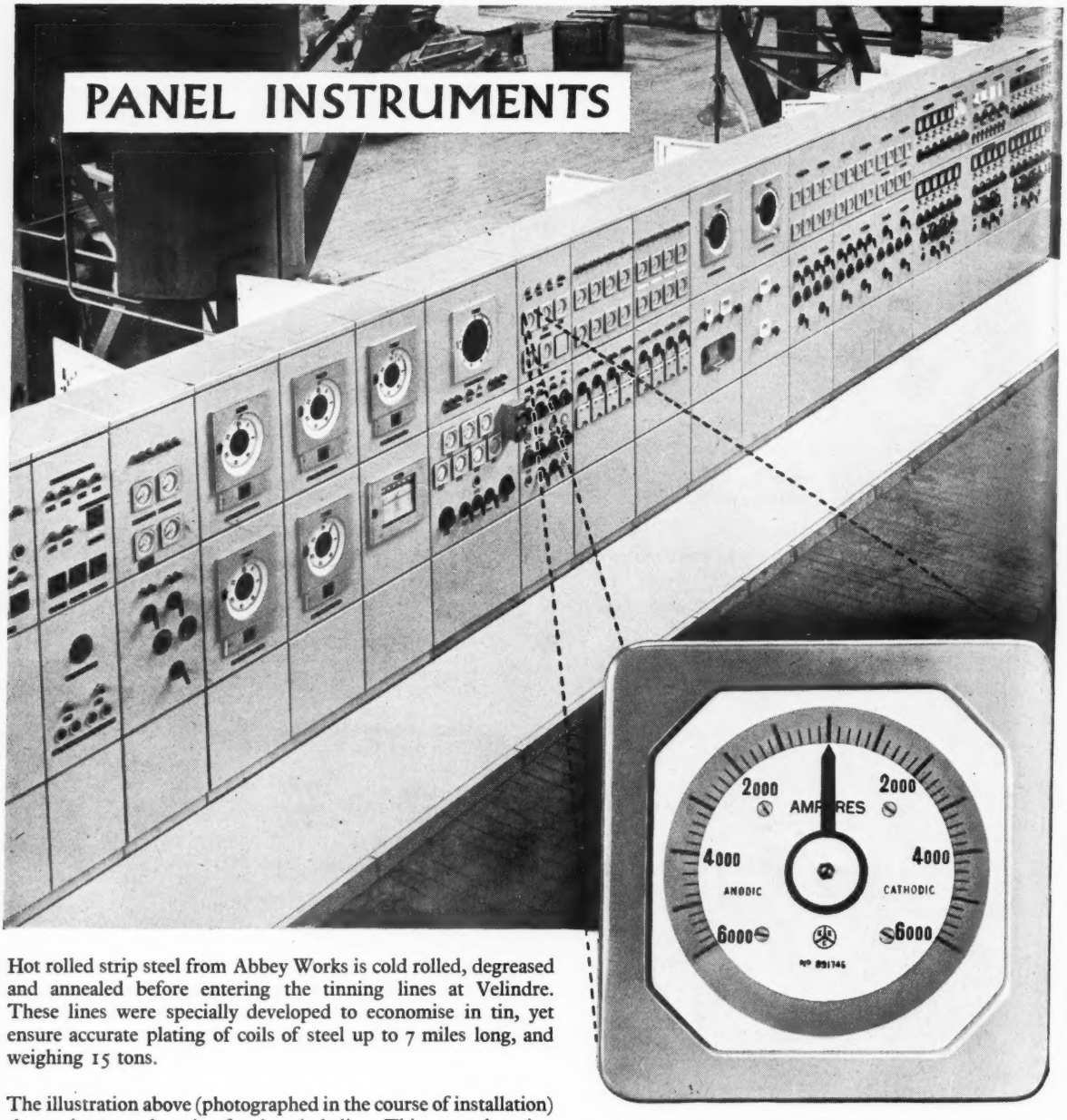

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ELECTRICAL REVIEW

9 August 1957 Vol. 161 No. 6 Established 1872

The New Leaders

WITH commendable promptness, the Minister of Power (Lord Mills) has announced the first and principal appointments to the new Electricity Council and Central Electricity Generating Board under the Electricity Act, 1957, which received the Royal Assent on 17th July. Much of the speculation and, indeed, unrest engendered by the uncertainty of the past nineteen months (since the Herbert Committee's report was presented) is now set at rest, although a great deal of rearrangement yet remains to be done.

As was generally expected, Sir Henry Self, the present deputy-chairman (administration) of the Central Electricity Authority, becomes chairman of the Electricity Council, and rumours that Sir Christopher Hinton was to take over the Generating Board are confirmed. Sir Josiah Eccles has accepted the deputy-chairmanship of the Council and it seems most probable that he will eventually succeed to the chairmanship. Professor R. S. Edwards will contribute his experience as an economist to an industry which is fairly delicately balanced in the economic sense, being both a commercial undertaking and a national service.

It may be taken that Sir Christopher Hinton's appointment arises largely from the increasing contribution which nuclear energy is expected to make in the future generation of electricity; it is in fact a sign of the times. It must be remembered that Sir Christopher is an engineer besides being an able administrator. His deputy-chairman, Mr. C. R. King, is a popular figure in the industry and has had many years of experience in responsible positions. He is one of the Electricity Board chairmen who have reorganised the administrative structure of their areas.

The selection of Messrs. F. H. S. Brown and E. Long as full-time deputy-chairmen of the Generating Board will be gratifying to the staffs of the new organisation as an indication that they, too, may be able eventually to arrive at the senior positions in the industry—that there is no insurmountable wall between the Boards and the executive staff.

Another thing which will please the staffs of the industry is that the limitation on salaries imposed by the remuneration of Board chairmen and members has been raised. This was a recommendation of the Herbert Committee and the " rise " was recently foreshadowed in Parliament when it was announced that Ministers' salaries were being increased.

The present is an opportune moment to say something about Lord Citrine who is to continue as chairman of the C.E.A. for the rest of the year and will then be a part-time

member of the Electricity Council. Few men could have refashioned the electricity supply industry with such successful results, for it must be remembered that when he took over in 1947 there were something like 600 separate units. These were of all kinds and sizes, some owned by companies and some by municipalities. Apart from the resentment which nationalisation caused among them there was a colossal human problem involved. Lord Citrine, ably assisted by his colleagues on the Authority and Area Boards, brought the units together, overcoming innumerable difficulties, and at the same time achieved that operation with the minimum of distress to the many thousands of people employed in the industry. Lord Citrine has thus served the country well as the architect of a structure so sound that others can continue to build upon it without fear for the foundations.

SCOTTISH NUCLEAR STATION

Both the South of Scotland Electricity Board and the G.E.C.-Simon-Carves group will be relieved by the decision of the Secretary of State for Scotland to allow the group to proceed with the Board's proposed nuclear power station at Hunterston, Ayrshire. Even now the exact position has not been settled but no doubt it will be possible to commence work on the site.

An unfortunate delay has been caused by the illness and subsequent death of the Commissioner who held the original inquiry and the necessity to appoint a successor who had to conduct a second (mercifully abbreviated) inquiry. This has sadly handicapped the constructors in the race to complete the first real nuclear power station in which the other competitors are the A.E.I.-John Thompson Nuclear Energy Co. (Berkeley) and the Nuclear Power Plant Co. (Bradwell).

NEW STEEL WORKS

The outline description in this issue of the new Ravenscraig (Lanarkshire) iron and steel works of Colvilles, Ltd., is a reminder that a new steel works is far from being an everyday development. It is exceptional in these times for a completely new steel works to be put into commission in so short a time as, say, eight or nine years after the last one, namely, the Port Talbot works of the Steel Company of Wales, Ltd. The days of the small iron and steel works are evidently over and economics now appear to demand large output in which electricity plays a fundamental part.

Although the Ravenscraig works is considerably smaller than that at Port Talbot, it is still a vast undertaking which will handle 1,600,000 tons of iron ore per annum and it has a blast furnace with an output of 1,000 tons of pig iron per day. The electrical importance of the undertaking is reflected by the fact that the works power station, with an initial capacity of 8 MW, will run in parallel with a 33 kV public supply.

WEST HAM SANDWICH COURSE

Mr. E. A. Rudge, M.Sc., Ph.D., Principal of West Ham College of Technology, says that his experience there indicates a serious shortage of opportunities for young people because industry is making its plans all too slowly. He thinks it extremely likely that many promising grammar-school leavers will have to be turned away this session on account of the shortage of places in suitable firms.

The West Ham sandwich course, which incidentally is for training in chemical engineering, was established with twelve students as a works-based scheme. The scheme has proved attractive to both industry and student alike, and it carries exemption from the associate membership examinations of the Institution of Chemical Engineers. As a result of wide publicity by press and radio, there have been many applications from grammar schools and it has been possible to place a sufficient number in industry to run two groups, staggered over the coming session, one intake commencing in September and the second next March.

Mr. Rudge states that there has been considerable resistance to a works-based scheme and present indications are that several likely applicants who could easily be accommodated at the College will have to be rejected for lack of sponsoring firms. There does not appear to be a single reason for the apparent apathy on the part of industry and yet on every hand there is evidence of a grave shortage of engineers for some years to come. Experience at West Ham suggests that there is an urgent need for industry to consider Lord Hailsham's recommendation to industrialists to revise apprentice schemes and recruitment policies to cope with the coming increased flow of school leavers.

ELECTRICITY AND CHEMICALS

In his article showing the influence on public electricity supply of the chemical industry, in this issue, Mr. W. E. Swale makes it quite clear that progress in the chemical industry is very largely dependent on that of the electrical industry. In the year to 31st March, 1956, the Area Boards supplied about 4,500 million kWh to the chemical industries while about 40 per cent of the electricity consumed by the chemical industry was " privately " generated. Mr. Swale also explains that many of the processes involved in chemical manufacturing have been made possible only by the flexibility of electrical applications to heating and power and particularly because of the inimitable versatility and precision of electric (including electronic) control.

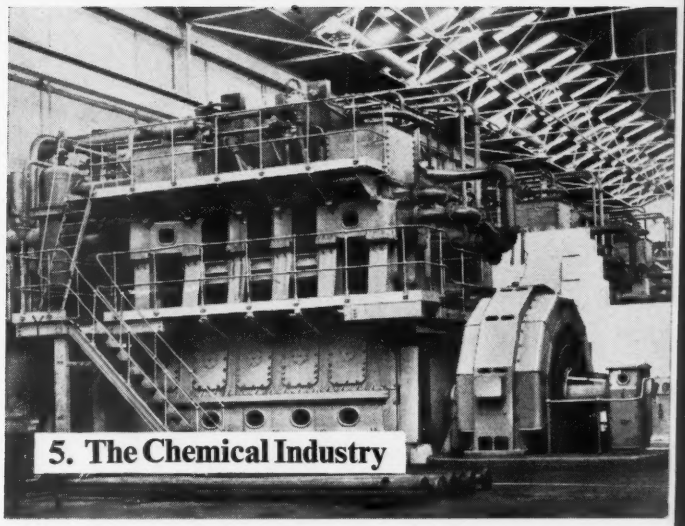
It is interesting to study the interdependence of coal and electricity production on the one hand and steel and electricity production on the other, and so realise how closely linked are both the coal and steel industries with the chemical industry by reason of the modern by-product installations which are largely common to both.

BLANKETS AND PADS

In the next of our illustrated surveys of domestic electrical equipment (16th August issue) electric blankets and pads will be reviewed. Particulars, to be given in tabular form, will include details of size, method of control, colour, material, loading, price, purchase tax, etc. On 6th September we shall be dealing with electric cookers

Industrial Influence on Public Electricity Supply

By W. E. SWALE, M.I.E.E., A.M.I.C.E.



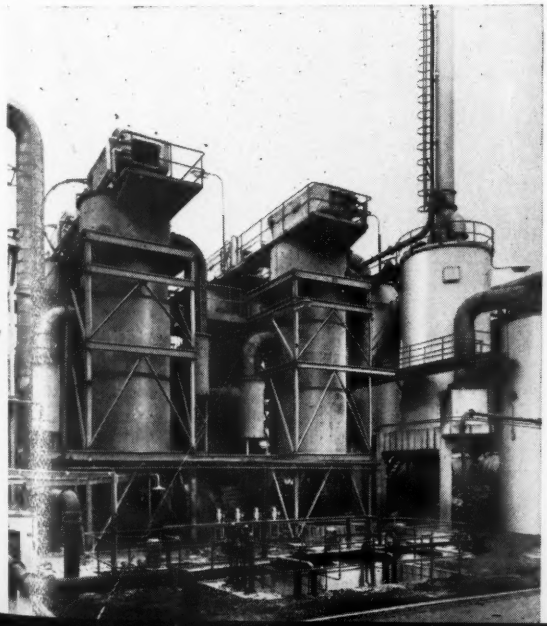
5. The Chemical Industry

One of seven 1,900 h.p. 11 kV synchronous motors, working at 0·9 leading power factor, and driving a 350 atm compressor. (Imperial Chemical Industries, Ltd.)

THE recent achievements of the chemical and allied trades represent one of the brightest facets of British industry. With vision and courage the leaders of the chemical industry have set about the task of drastically overhauling pre-war production methods and have partially completed a programme of capital investment which was needed to meet the challenge of the post-war age. Between 1949 and 1953 some £200 million was spent on rehabilitation and enlargement of plant. A further £230 million was to be spent between 1953 and 1957. The value of capital equipment was increased from £1,600 per employee in 1948 to £2,700 in 1952. Output per worker has risen in volume by 21 per cent since 1948.

The industry covers a wide range of products, the majority of which form the basic raw materials for other industries. Many of the processes involved can only be carried out in large manufacturing units. The heavy chemical industry of this country has a long history, which can in certain firms be traced back well over one hundred years. Its weaknesses, which were particularly exposed with the outbreak of the first world war, were largely responsible for the drawing together into one combine of a number of the oldest firms. As a result there has come into being the largest industrial undertaking in the British Empire. This one great chemical combine alone employs about 100,000 workers in approximately 100 factories, which manufacture a range of roughly 12,000 different products.

Fig. 1.—Electro-precipitators for removal of acid mist at a sulphuric acid plant. (Simon-Carves, Ltd.)



Much information about the chemical industries is given in a series of eighteen brochures which cover the Census of Production for 1951. The titles of these are listed in Table I, which also gives the number of workers employed in the four major groups, as quoted in the *Monthly Digest of Statistics*.

The total number of workers in these industries has risen by 20 per cent since June, 1948. To-day it represents 5·7 per cent of the total employed in the manufacturing industries in Great Britain. The total number of "larger establishments" listed in the Census of Production in 1951 was 1,907.

Distribution of Chemical Industries

Basic industries, e.g. shipbuilding, steel, cotton and wool, are situated in areas which have become traditional. Similarly, certain conditions have tended to nurture the long-established heavy chemical industries in the north-western parts of the country, notably Widnes, Warrington, Runcorn, Liverpool and Manchester. Chief among these

TABLE I.—CHEMICAL AND ALLIED TRADES

Item	Class of Manufacture	Men and women employed at July, 1956 (000)	Percentage of total
1	(A) Coke ovens and by-products, (B) Dyes and dyestuffs, (C) Fertilisers, disinfectants, insecticides and allied, (D) Coal tar products, (E) Chemicals-general, (H) Explosives and fireworks, (M) Match ...	302·0	57·3
2	(F) Drugs and pharmaceutical preparations, (G) Toilet preparations and perfumery, (J) Soap, candles and glycerine ...	110·8	21·1
3	(N) Mineral oil refining, (O) Oils and greases, (P) Seed crushing and oil refining, (Q) Glue, gum, paste and allied, (R) Plastic materials	71·2	13·5
4	(I) Paint and varnish, (K) Polishes, (L) Ink	42·5	8·1
	Total	526·5	100·0

The capital letters refer to the various brochures mentioned above.

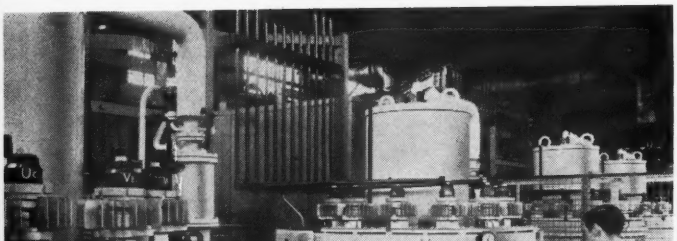


Fig. 2.—Mercury-arc rectifiers, each of 4,000 A, voltage variable up to 230 d.c., in modern chlorine plant

conditions were no doubt the vast natural deposits of salt in Cheshire, and of limestone in Derbyshire and North Wales. Other factors were the proximity of coalfields, the concentration of colour consuming industries, e.g. textiles, rubber, paint and linoleum, and not least the construction of the Manchester Ship Canal. Those who know Lancashire will think it fitting that the smokiest of all counties should have been the home of soap making.

Other concentrations of chemical industries took place later, for instance, in County Durham, whilst more recent developments in petroleum refining have for obvious reasons been sited near to the larger seaports. The lighter side of the industry, for instance, pharmaceutical preparations, paints and plastic materials, lent themselves well to operation in special " development " areas. A few very heavy users chose sites adjacent to power stations. The returns from Area Boards therefore indicate substantial chemical loads in many parts of the country; but the greater proportion of the load due to the heavy chemical industry is shared by the two Boards in the north-west.

Provision of Electricity

Because so many chemical processes, especially on the " heavy " side, require large quantities of low-grade heat, conditions often favour private generation by means of back-pressure turbines. The classical instance is that of Billingham which, together with its neighbouring works at Wilton, operates private generating plant of roughly 100 MW capacity. There are many other chemical works operating fair-sized private power plants and the proportion of self-generated electricity in the industry is about 40 per cent. Aggregating the detailed returns received from the majority of the Area Boards, and making careful allowances for the few which sent in incomplete returns, it appears that in the year to 31st March, 1956, the chemical industries purchased very nearly 4,500 million kWh. These represent nearly 14 per cent of the total of 32,431 million kWh sold by the Boards under the heading "Industrial Sales." The aggregate demand of the chemical group came to about 780,000 kW, i.e. just over 9 per cent of the sum of the individual industrial demands on the Boards. Table II shows the way electricity is provided.

TABLE II

		kWh × 10^6	% (appx.)
Purchased from Electricity Boards		4,500	60
Generated by private plant:—			
By chemical firms	2,740		
By oil refineries	220		
	2,960	2,960	40
		7,460	100

Yet electricity sales by Boards to chemical works are steadily rising and suggest a trend similar to that noted in other basic industries. Consumption is continually growing because electrical energy, not only for direct power applications, but also for resistance heating and for electrolytic and electro-thermal applications, gives better results than the processes that were evolved in the early days of the chemical industry when electricity was not as widespread and far less adaptable than it is to-day.

The problems of private generation in a chemical works plant, of standby supplies from an Area Board, and of parallel operation, offer great scope for both technical and economic co-operation. A number of mutually beneficial supply agreements of this kind are in operation, in which the overriding interest has been that of national fuel economy.

Basic Chemical Products

Certain processes have tended to merge into a common pattern in all the leading industrial countries. The most important basic commodity is sulphuric acid of which it has been said: " It can be traced in some stage of manufacture of almost any industrial product that can be named." Its use has grown enormously in recent years, especially in the manufacture of synthetic fertilisers and man-made fibres. The production in this country now runs at about 2,300,000 tons per annum. Of this quantity some 40 per cent goes to the manufacture of ammonium sulphate, 20 per cent to other chemical products, and 11 per cent to petroleum refining.

In the " contact " process by which the acid is normally made, pyrites or other sulphur-bearing materials are burned or roasted to produce sulphur dioxide. This gas is then converted catalytically into sulphur trioxide which is absorbed in strong H_2SO_4. The solution is diluted to produce the net gain acid. Electricity is normally used as power for driving blowers, sulphur and acid pumps, etc. Electricity consumption varies between 20 and 80 kWh per ton of acid. In some plants the roasting of pyrites enables substantial quantities of waste heat to be recovered and the process favours private generation of electricity. Instrumentation is largely employed, and one operator per shift may be able to work the complete plant.

An interesting application of electricity is the high-voltage d.c. electro-precipitator (Fig. 1) which is used for separating-out the acid mist droplets coming from the plant. The appliance is also used in pyrites plants for precipitating pyrites dust from the roaster. The voltage used ranges between 30 and 75 kV, and the power consumption from 0·2 to 1·0 kWh per 100,000 cu ft of gas treated.

The manufacture of chlorine gas and caustic soda is another example of a basic process which has assumed enormous proportions in recent years, the raw materials being merely salt together with water, air and fuel. The industry grew up largely in the north-west of England. Chlorine is embodied in many synthetic organic chemicals, and caustic soda is also required in a wide range of industry. Production figures for the United

Kingdom are not available, but in the U.S.A. the output of chlorine in 1953 was over 2,000,000 tons with an even greater output of caustic soda. The interest of these products lies in the fact that whereas the original soda ammonia (the Solvay) process was based on chemical reactions the modern plants employ electrolysis for breaking down brine into chlorine.

Of the two types of cell now commonly used, the diaphragm cell and the amalgam (mercury) cell, the latter is proving the better because the resulting caustic soda is superior for subsequent use in rayon manufacture. The amalgam cell has two compartments—the cell proper in which brine is electrolysed to produce chlorine gas and sodium amalgam, and a decomposer in which the amalgam is, in turn, converted to sodium hydroxide and hydrogen while regenerating mercury. In the cell itself the graphite electrodes dip into the brine solution from above and the mercury flows along the floor of the cell concurrently with the brine. Fig. 2 shows a bank of rectifiers used in a British plant.

In a recently started Italian plant, designed for 10 tons of chlorine per day, the d.c. supply is about 15,000 A at between 80 and 100 V. The overall power consumption is about 3,350 kWh per ton of gas.

The manufacture of calcium carbide, from which acetylene gas is generated, is a particularly interesting example of the direct application of electric heat on a large scale. Acetylene gas was known, a little more than fifty years ago, mainly as a conveniently portable but strangely smelling illuminant. To-day, it is not only widely used for welding and flame cutting in engineering, but it also forms the raw material of an important branch of the chemical industry, i.e. the synthesis of solvents and plastics of the p.v.c. group. The process consists essentially in smelting a mixture of coke and lime in three-phase "submerged-arc" furnaces in which temperatures of the order of 4,000 deg C are reached. The annual production of calcium carbide in the United Kingdom is approximately 150,000 tons. The quantity of heat required theoretically for the production of one ton of carbide is the equivalent of 2,790 kWh. The power requirements of a complete plant, which also includes coke preparation, air washing and other auxiliary processes, crushing and screening the finished product, and the making of steel drums are, therefore, considerable. In one large plant the supply is brought in from a C.E.A. grid point at 33 kV through two transformers of 45 MVA each. (The process was fully described in a paper by C. J. Beavis, read before the I.E.E. in 1954, under the title "The Use of Electricity in the Production of Calcium Carbide.")

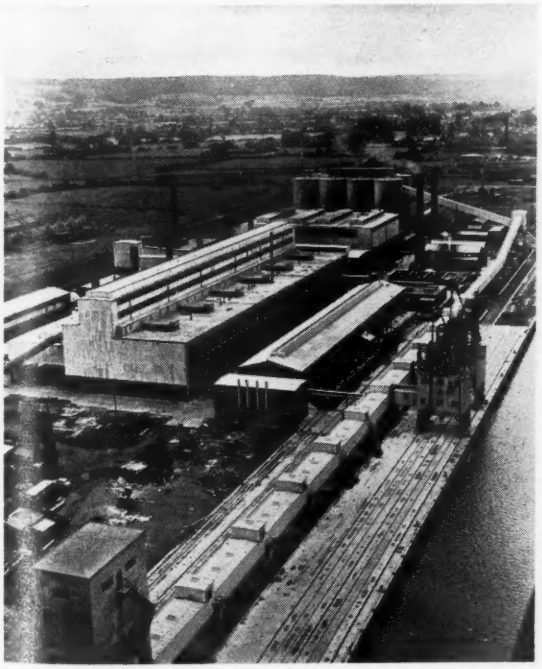


Fig. 3.—Aerial view of a new phosphorus plant. (Albright & Wilson, Ltd.)

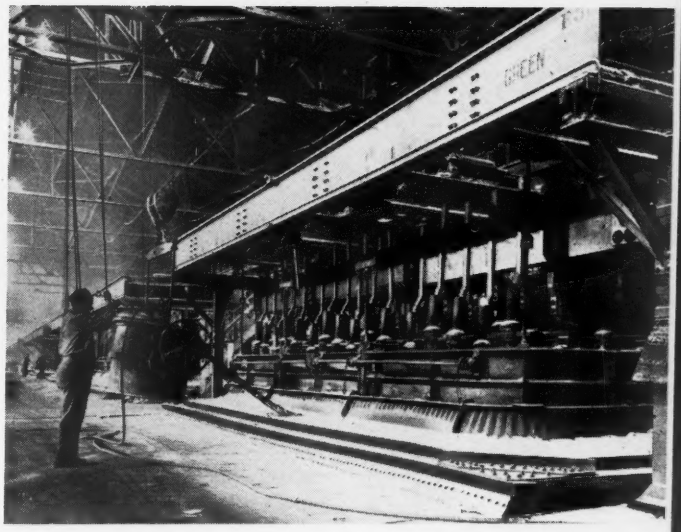


Fig. 4.—100,000 A 5 V cells used in electrolytic reduction of aluminium at Lochaber works. (British Aluminium Co., Ltd.)

A further example of the application of direct electric heat in considerable quantities is found in the manufacture of phosphorus. For many years the demand was small, its main use being in the manufacture of matches. To-day, derivatives of phosphorus, largely in the form of phosphoric acid and phosphates, are in rapidly increasing demand. As a result the manufacture of phosphorus has extended very rapidly in recent years. One new plant alone (Fig. 3) was designed to produce 18,000 tons a year.

Basically, the process consists in smelting in large carbon-lined arc-furnaces a mixture of phosphate rock, anthracite and silica. The three-phase furnaces vary in rating up to a maximum of 7,500 kVA. The power factor is inherently high, and as the furnaces work continuously, being stopped only for short periods in order to screw on fresh lengths of carbon electrode, load factors of 90 per cent monthly and about 85 per cent annually are attained.

Aluminium and Magnesium

The production of these two complementary light metals properly falls within the trade category "Metal Manufacture (Non-Ferrous Metals)," but it may be mentioned because both processes are entirely electrical and these metals cannot as yet be produced in any other way. The aluminium plant at Fort William involves maximum demands of about 64 MW and an annual load factor of close on 87 per cent.

The process depends on the electrolytic dissociation of a solution of purified aluminium oxide in a flux composed mainly of cryolite. The action takes place between carbon electrodes at a temperature of 970 deg C. Metallic

Fig. 5.—Removing magnesium metal from an electrolytic cell. (Magnesium Elektron, Ltd.)

aluminium forms in a pool at the bottom of the bath (the cathode of the cell) and oxygen is released and burns at the anode. Fig. 4 illustrates a cell taking 100,000 A, though cells of 150,000 A are also in use. The main anode conductor can be seen running right across the top of the furnace. Actual contact with the carbon is made by the carrot-shaped stubs.

The last example of a large-scale electro-chemical process is the manufacture of magnesium. World production of this metal in 1955 was approximately 124,000 tons, of which nearly 85 per cent was made in the U.S.A. and in Russia. The small United Kingdom contribution (only about 1·2 per cent) is to some extent bound up with the price of electricity.

Magnesium, the lightest of the structural metals, was discovered by Davy nearly 150 years ago, but commercial exploitation began only about 1926. To-day it is widely used, almost exclusively in the form of magnesium based alloys, in both commercial and military fields. Examples of successful applications are the manufacture of aircraft landing wheels, its use in the Volkswagen engine (the largest single user of magnesium in the world) and its growing use in the prevention of corrosion of iron and steel structures.

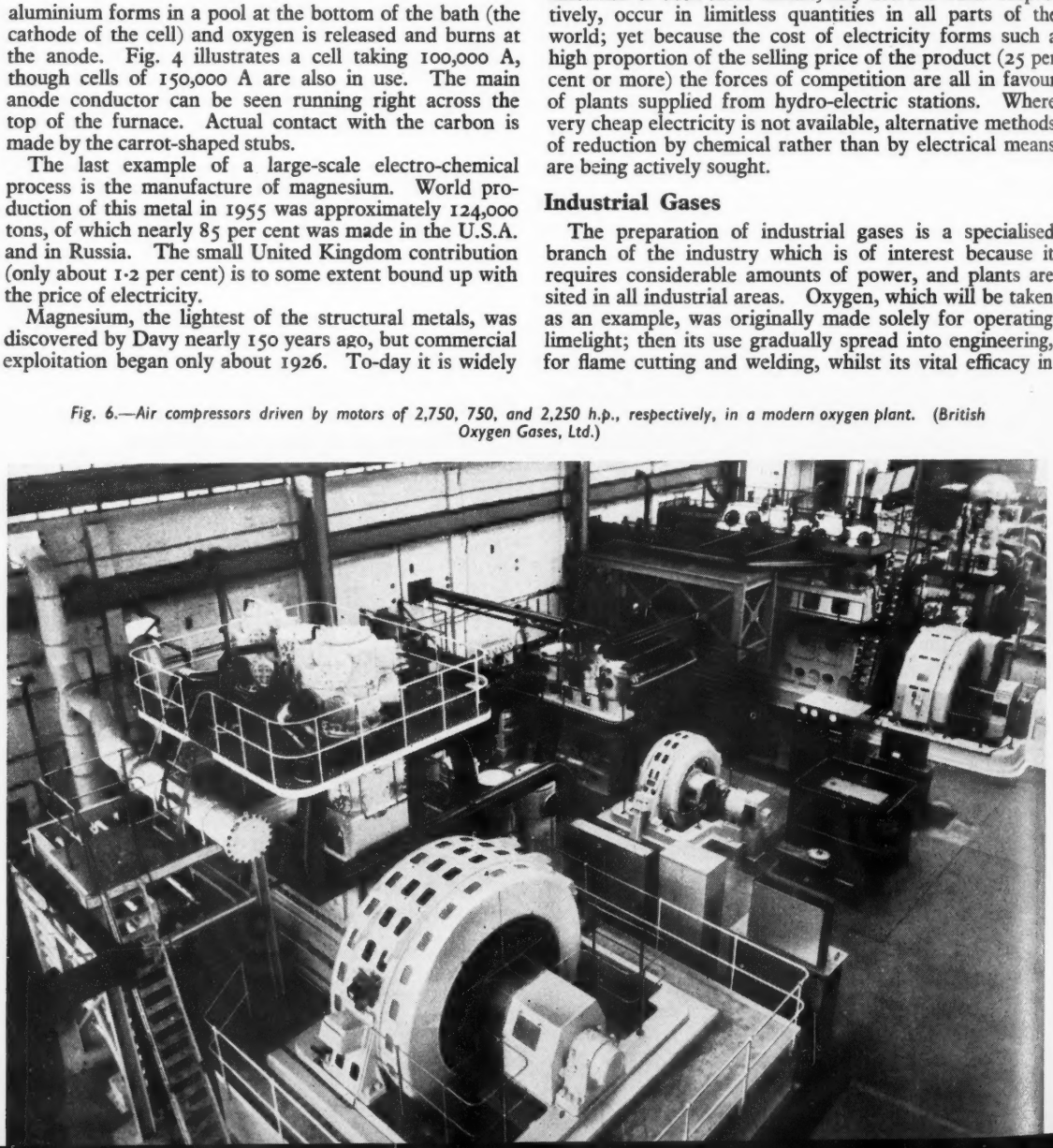
In a well-known British plant molten magnesium chloride is produced by the chlorination of caustic magnesia in the presence of coal. This molten chloride is reduced to magnesium metal in electrolytic cells which have graphite anodes and cast steel cathodes. The temperature in the cell bath is regulated between 720 and 750 deg C and the process is continuous. Chlorine is drawn off from the anode chambers, and the electrolysed metal, which floats on the surface of the cathode compartment, is removed by hand scoops (Fig. 5). The metal has to be further treated before being cast into the final ingot form.

In the process outlined above about 70 per cent of the load is electrolytic, and the remainder is made up of electro-thermal and ancillary processes. The annual load factor of the plant is slightly over 80 per cent. The raw materials of both these metals, clay and sea-water respectively, occur in limitless quantities in all parts of the world; yet because the cost of electricity forms such a high proportion of the selling price of the product (25 per cent or more) the forces of competition are all in favour of plants supplied from hydro-electric stations. Where very cheap electricity is not available, alternative methods of reduction by chemical rather than by electrical means are being actively sought.

Industrial Gases

The preparation of industrial gases is a specialised branch of the industry which is of interest because it requires considerable amounts of power, and plants are sited in all industrial areas. Oxygen, which will be taken as an example, was originally made solely for operating limelight; then its use gradually spread into engineering, for flame cutting and welding, whilst its vital efficacy in

Fig. 6.—Air compressors driven by motors of 2,750, 750, and 2,250 h.p., respectively, in a modern oxygen plant. (British Oxygen Gases, Ltd.)



many realms of medicine has led to a large demand. Nowadays, oxygen, in liquid or gaseous form, is being used in rapidly increasing quantities for metallurgical processes, and particularly in steel making, in which it helps to increase output quite appreciably. As a result many new oxygen plants have been put down.

Oxygen is produced by the compression and cooling of air, followed by expansion. By the fractional distillation of the resulting liquid air liquid oxygen is obtained together with a percentage of impure nitrogen. By an extension of the process some pure nitrogen can also be obtained. Other atmospheric gases, e.g. argon and neon (present in air in very small quantities) can also be recovered when required. In a typical modern factory the maximum demand is approximately 5,250 kW, with an annual consumption of 38 million kWh (annual load factor 82·5 per cent). A group of air compressors is shown in Fig. 6.

Oil Refining

A feature in recent years has been the remarkable increase in number and size of the great oil refineries. Some interesting details of one of these plants may be quoted. The annual consumption of electricity is at present 175 million kWh, and is still rising rapidly. The maximum demand is nearly 24 MW, and the annual load factor about 84 per cent. There is little difference between the day and night loads. An approximate analysis of the power requirements is as follows:—

	per cent
Pumping (excluding sea-water)	46
Pumping sea-water (for process cooling)	29
Air and gas compressors	18
Lighting, instrumentation, and auxiliary services	7
	100

No direct electric heating is used in the refinery processes. There is, however, adoption of electrically "traced" fuel oil pipelines. An existing installation is designed to keep the oil at 390 deg F during transit through the pipelines to the furnace burners. A further installation, now planned, is to comprise 3,600ft of 4in pipe, in which the fuel oil is to be kept at 450 deg F.

Fig. 7 illustrates a large motor driving the centrifugal air compressor on the hydro-former. This is a 3,000 V squirrel cage motor which is started direct-on-line.

In these huge refineries instrumentation and a high degree of automatic control have been achieved. These plants probably represent the nearest approach, at present, to the ideal of the "automatic factory."

Conventional Electrical Applications

Power is used to some extent in every chemical works, for instance in conveying solids, liquids or gases, in grinding, pulverising, screening, mixing and countless other processes. The makers of chemical plant have rapidly become aware of the advantages of individual electric driving. Fig. 8 illustrates the top of a 1,000 gallon resin kettle. The 20 h.p. motor, connected by reduction gearing to the vertical spindle (which in turn drives an anchor type agitator inside the kettle) follows good modern practice.

The form of "Isotape" or "Isopad" heater, used in "tracing" pipelines which have to be heated, rests on the use of insulated resistance cords interwoven with glass yarn. The resulting tapes, pads, blankets, etc., can withstand quite high temperatures and their use as surface heaters is rapidly extending. One of the many applications of this form of electric heat is shown in Fig. 9, facilitating the handling of the acetic acid in the drums.

Mention may also be made of the resistance heating of pipes at low voltage, using the pipes themselves as the heating elements. The use of induction regulators in the control of electrically heated vessels is also practised. A recent development is that of electric induction heating in the construction of alkyd resin plants. The centre tank in Fig. 10 is fitted with three-phase low-voltage induction heating elements totalling 70 kW. On top of the tank can be seen a vertical motor and gear box driving the agitator. In this plant the motor and other electrical gear have to be of flameproof construction.

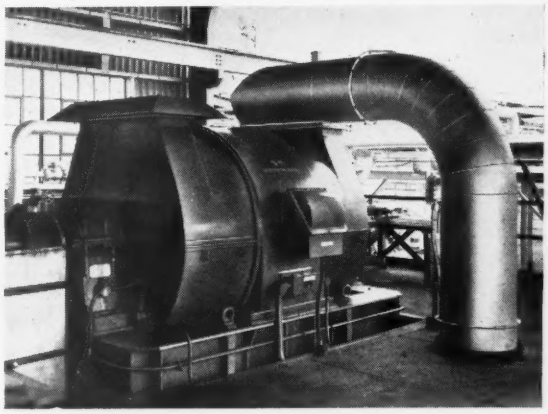


Fig. 7.—3,000 h.p. 1,500 r.p.m., s.c. pipe-ventilated motor driving a centrifugal air compressor. (Esso Petroleum Co., Ltd.)

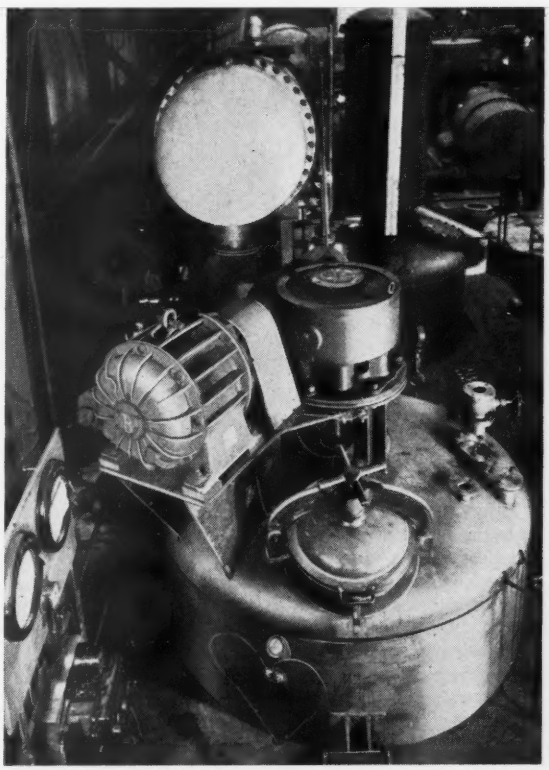


Fig. 8.—Top of 1,000 gallon resin kettle with electrically driven agitator. (L. A. Mitchell, Ltd.)

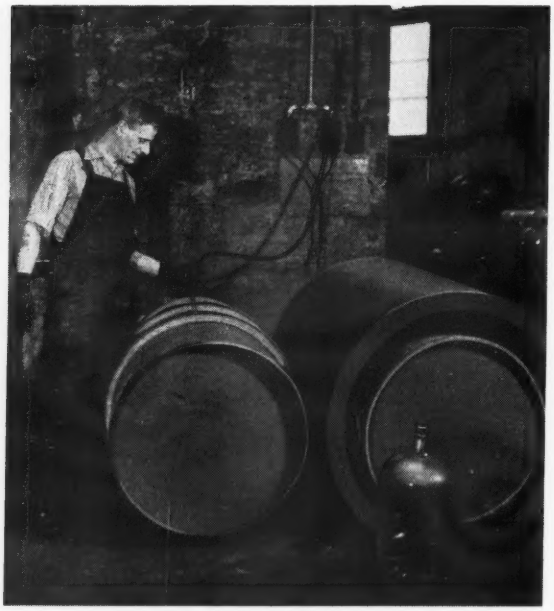


Fig. 9.—Surface heater designed to warm up contents of 90 gallon drum. (Isopad, Ltd.)

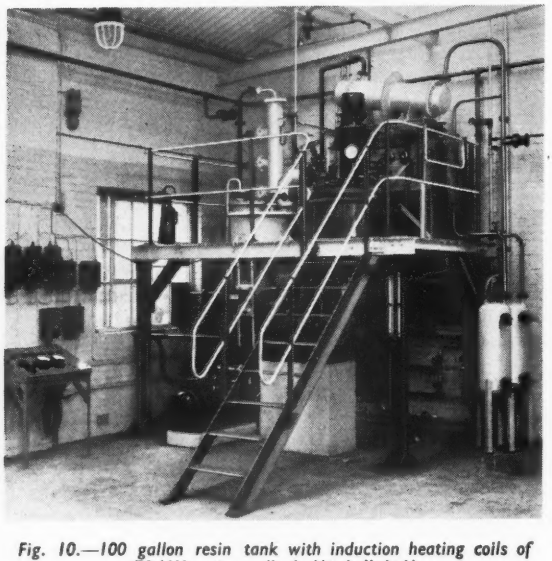


Fig. 10.—100 gallon resin tank with induction heating coils of 70 kVA rating. (L. A. Mitchell, Ltd.)

A final example of an up-to-date heating plant is taken from the pharmaceutical side of the industry. A dry heat steriliser with a temperature range of 250 to 300 deg C is used to dry out glass ampoules, and then to bake on to their interior surfaces a silicone coating. This coating permits the very accurately weighed charge of some antibiotic preparation to be emptied out completely.

In this brief and far from comprehensive survey of a most important industry it has only been possible to refer to a few of the major uses of electricity and to account for some of the great amounts of electrical energy which are called for. An equally instructive story could be written of the many uses of electronics, instrumentation and automatic control already adopted in an industry which has to be particularly alive to modern developments. Enough has perhaps been said to indicate that "the atoms of Democritus" form an unusually fruitful field for co-operation with electrical engineers, and one, moreover, which by reason of its generally high load factors is of the greatest value to the electricity supply industry.

In conclusion, the writer gratefully acknowledges the help given freely by chief commercial officers of Area Boards, and of many friends in the chemical industry. So much information was in fact offered in connection with this article that it has not been possible to include it all.

Health and Safety in Welding

THE Health and Safety Sub-Committee of the Institute of Welding is preparing a series of information sheets under the general title of "Accidents and their Prevention," and the first of these has now been published. It deals with the dangers of carelessly releasing free oxygen gas into confined spaces. Future sheets will deal with the following topics:—Recommended Safety Precautions during Inert-Gas Arc Welding; Common Faults in Arc Welding Equipment; Common Faults in Gas Welding Equipment; Welding in Confined Spaces; Arc-eye and other Eye Injuries; Explosions—How They are Caused; Welding Fumes and How to Remove Them; Site Welding Safety Precautions; and Emergency Action in Case of Accident.

It is hoped that these information sheets will encourage workpeople to be more conscious of the common causes of accidents in the use of welding and cutting equipment, and that they will help to reduce the number of accidents still further. They do not replace the Institute's publication "Health and Safety in Welding," which is a reference book. In the preparation of these sheets the sub-committee is taking particular care to avoid any impression that welding is a hazardous job. It is explained that welding is one of the more healthy industrial occupations and that, with the exercise of a little care, accidents can almost always be avoided.

South African Electrical News

A NEW Victoria Falls power scheme, beyond the reach of Zambesi floods, is being drawn up by consultants to meet the growing need for power at Livingstone. Above the eastern cataract a canal will take water from the Zambesi, carry it two miles through the bush and return it into the river at the bottom end of the fifth gorge below the Falls. Standing on the lip of the precipice at this point, an official of the Board indicated that the water would plunge 480ft to the high-water mark in the gorge below. With so great a head, only 7,500 gal of water a second need be diverted from the Zambesi above the Falls to generate 40,000 kW. The present power station, which narrowly survived the recent floods, has a maximum capacity of 8,000 kW. Experts propose that water from the new canal should rejoin the Zambesi in the fifth gorge through a vertical tunnel, with the turbines underground at the bottom. The canal, tunnel and power house are expected to cost about £1,000,000, if approved, and the generating plant another £750,000.

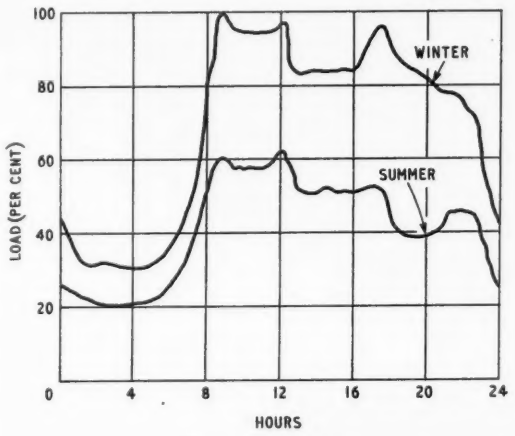
The director of the South African Bureau of Standards has issued a national warning on certain electrical toys now appearing on the South African market. Some of these toys operate on full mains voltage and are potentially dangerous. The Bureau has been approached by both the Association of Municipal Electricity Undertakings and the Safety Precautions Committee to prepare safety specifications for toys of this type. Should such specifications be drawn up and declared compulsory they would bar dangerous toys from the South African market. Until these specifications are available, the Bureau recommends great care in buying electric toys.

Nuclear Power and Load Curves

NATIONAL NEED FOR IMPROVED LOAD FACTOR AND TARIFF REFORMS

By G. O. McLean, M.Eng.

THERE is no doubt that the appointment of Lord Mills as Minister of Power and the semi-official pronouncements since his appointment mean that the Government is fully convinced that the sooner the country can swing over to nuclear energy (via electrical generation) the sooner will we be able to use a great deal more of our coal resources for conversion into oil for internal combustion engines or export in its raw state. This change is not only revolutionary to the extent of bringing the physicist into the power field and making the steam engineer solve fresh and complex heat-exchange problems, but the supply engineer outside the generating station is also forced to do some hard thinking on the present shape of the daily load curve. Typical national load curves are shown in Fig. 1 and are so well known as to need no further description. Attention must, however, be drawn to the size of the night valley. The minimum load (about 3 a.m. to 5 a.m.) is only 33 per cent of the maximum load, while of the 40 per cent area that is missing from the 100 per cent total when considering the typical 60 per cent load factor curve, fully 36 per cent is represented by the night valley hours extending from 9.30 p.m. to 7.30 a.m.

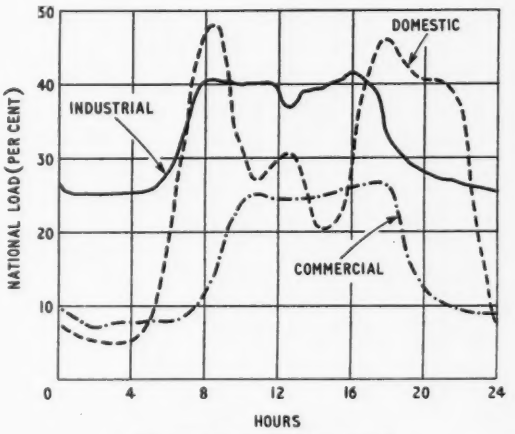


National load curves

The national curve is an aggregation of the loads demanded by the 12 Area Boards and carried by approximately 280 generating stations. In the ultimate analysis each piece of electrical apparatus has its own load curve, but it is only practicable to deal with broad classes of consumers. The regression analyses carried out by the Central Electricity Authority utilisation research committee showed that the three main classes contributed the loads shown in Fig. 2, though there are considerable differences for the same classes of load between one part of the country and another, depending on the type of industry served and the habits and working times of the domestic consumer.

Whereas one cannot live or work in the electricity supply industry without being aware of the need for load factor improvement, its relevance in the nuclear power age becomes infinitely more important. One has not to seek far for the reasons. Economics have figured largely in the past, and because capital costs per kW of station output will be probably three times the present coal-fired station costs, there is that much more urgency to spread the costs over a greater number of units per kW. Secondly, there will be control considerations and unknown effects on operating costs if load factor does not improve. We have been assured by the experts that reactors cannot "run away," that all controls operate to effect safety, and that the controls are automatic and almost instantaneous; but the author has also heard experts stress the need for base loads both for stations and individual reactors when on load.

Obviously, as the proportion of nuclear to coal stations increases, and the output of individual reactors increases, one cannot provide all of them with base loads unless the load factor climbs steadily. This immediately provokes the question: "How can load factor be improved?" particularly in view of the facts that the trend is to the shortening of the working week and eventually the working day, and also that man's health demands an average sleep for six to eight hours out of every 24. The short answer, it is suggested, is by radical changes in the tariff structure, so that thermal storage and night loads are encouraged for all classes of consumers—domestic, commercial and industrial.



Components of national load curves

Even with the small differential between energy prices for normal and off-peak loads, Area Boards are able to sell the small unit night-storage heaters (despite heavy capital costs per kW). Before nationalisation, when night loads could be sold at bare incremental generating costs, many large buildings were centrally heated from thermal storage systems at an economical figure. There is no technical reason (thermo-dynamic or electrical) why the

space heating load of the whole country should not be carried by thermal storage means.

Many analyses of consumer loads have been made in the past, and in areas where there has been a mixed load from industrial and domestic consumers (e.g. Schiller's analysis of Northmet pre-war load) space heating was found to be responsible for ¼ to ⅓ of the peak demand. If this load alone could be transferred from day to night, it would go a long way to filling the winter night valley. A great deal of space heating now done non-electrically would be attracted to thermal storage methods if the tariffs were suitable. The valley would then completely disappear, and though it would be impossible to eliminate all load variations a daily load factor of over 80 per cent would be feasible.

Price Levels Needed

Determination of the elasticity of this space heating load would not be easy, and hence it is not possible to give an exact figure for the price of night load that would cause a swing from day to night. We can, however, be guided by the incremental cost of generation, as used by the Central Electricity Authority, in making their case for pumped storage (Eccles, B.E.P. Convention, 1955). It will be recalled that a thermal efficiency of 35 per cent was postulated for the base load stations supplying energy at night for pumping from low level to high level reservoirs. It is a simple matter to calculate from this and the fact that the base load stations will be on the coalfields, that the incremental cost will be about 0·25d per unit. If the new Generating Board sold at this price to Area Boards, then the latter should be able to sell low-voltage units at 0·3d or 0·33d; and it is certain there would be no sales resistance from the consumers.

One cannot be so certain as to the attitude which the commercial and accountancy sections of the supply industry might take to this revolutionary change. It would be difficult and hardly justifiable to separate existing night loads from those transferred from day to night or new loads that are created because of the favourable night tariff. All night load would, therefore, have to be charged at the proposed low rate; and ultimately, with a near 100 per cent load factor and the 24 hours divided equally between day and night, half the energy would be sold at the low rate and half at the full rate. This sounds, on first reading, to be so drastic as to be almost financially suicidal unless the present day rates were increased considerably to maintain overall revenue. Further reflection, however, will reveal that this is not so. Though half the energy sold would have to carry the full capital, depreciation and operating fixed costs (wages, welfare, etc.) this is no different from a system with a 50 per cent load factor.

A drop from the national average of 60 per cent to 50 per cent load factor means only a 20 per cent increase in the fixed costs component of the total energy cost, or about 10 per cent of this total. The consumers would willingly pay this rate, if they were getting the other half of their energy requirements at the incremental rate—roughly one-third of the day rate. Thus, both suppliers and consumers should be satisfied, and the conditions for efficient operation of nuclear generating stations would be created. Unfortunately, revolutions don't just happen, and there is need for a driving force to start the wheels moving.

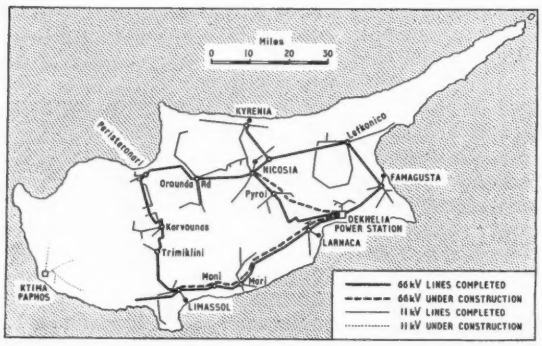
As with the Central Electricity Authority's nuclear station building programme, so with this tariff question, boldness will pay, and will ensure that this country stays ahead of the world in nuclear power.

It will not do to wait until the stations are built and need their 100 per cent loads. We should start now, as in the domestic field the education of architects and builders will take many years, despite the simplicity of "building in" a shallow thermal storage tank of a few hundred gallons capacity under the living room of each domestic dwelling.

Electricity Supply in Cyprus

APART from the state of emergency in the island itself, the Cyprus Electricity Authority last year had to contend with difficulties resulting from the Suez crisis and shipping strikes. In spite of these adverse factors, however, good progress was made with the island-wide electrification scheme. This has now reached the point at which attention is being given to the start of works included in the fourth stage.

The second extension of the Dekhelia generating station and the construction of the 66 kV transmission system, part of the third stage, are expected to be completed by the end of the year. The station will then contain two 7 MW and three 14 MW sets. Last year 103·9 million kWh was generated at this station, with a load factor of 45·7 per cent. Small amounts of power were also produced at Paphos and at various diesel stations, making the total 104·9 million kWh, against the 1955 output of 73·5 million. The number of consumers supplied increased from 4,345 to 5,086.

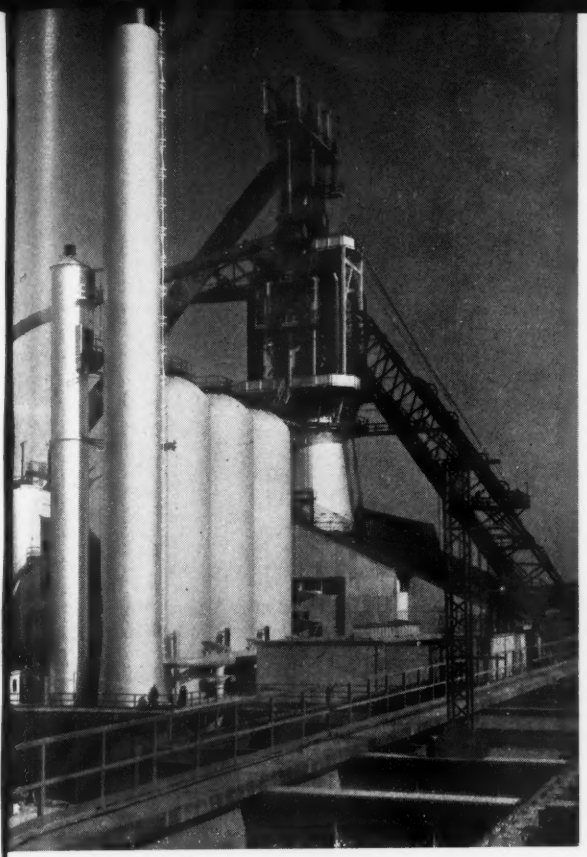


Extensive construction works were carried out to meet the requirements of new residential areas in the suburbs of the larger towns. In addition, reconstruction of the old distribution networks was continued and major reinforcement of the supply system was undertaken to keep pace with the increasing demands. A new 66 kV transforming and switching station was built at Orounda Road to serve mining and rural irrigation requirements. During the year the Authority acquired several of the smaller undertakings on the island.

The report records six cases of damage to transformers by unknown persons, resulting in supply failures.

Gross revenue amounted to £1,014,476 and there was a net surplus for the year of £119,327, from which has been deducted the deficit of £63,285 brought forward from 1955. This is the first time since 1952 that it has been possible to carry forward a surplus. The present financial position of the Authority is considered to be satisfactory, but it is pointed out that further large capital expenditure will have to be incurred.

At the end of the year Mr. H. F. Carpenter, C.B.E., the chairman, was reappointed for a further term of office.



The Ravenscraig blast furnace

New Scottish Steel Works

EXTENSIVE DEVELOPMENT OF THE COLVILLE GROUP

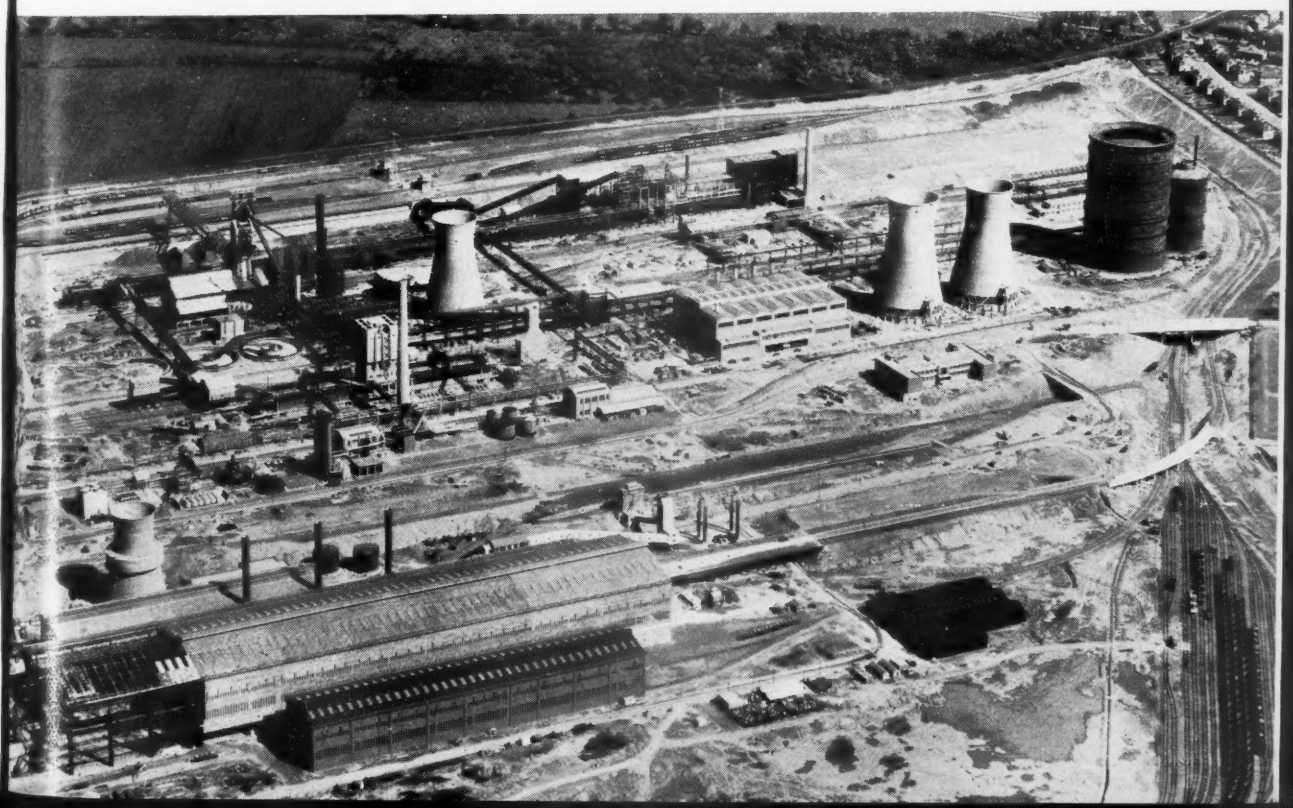
THE new Ravenscraig iron and steel works of Colvilles, Ltd., in North Lanarkshire was recently put into commission and we publish the following brief general description and hope to be able to publish a fuller account of the electrical installation and equipment a little later on.

The site is to the south-east of the company's Dalzell works and the plant has been linked with that works and also with the adjacent steelworks of the Lanarkshire Steel Company. It is over a square mile in area and is bounded on the east by British Railways' Wishaw Deviation Branch which will form the main supply artery for raw materials for the coke ovens and blast furnace. The South Calder Water forms a natural boundary on the north of the present development, but ample ground to the north and east of these boundaries is owned by the company and is available for future expansion.

The high-grade, foreign ore on which the blast furnace is designed to operate will be received at General Terminus Quay, Glasgow, which is being developed to handle the 1,600,000 tons ore traffic per annum. The ore is hauled in trains of specially designed, bottom-discharge rail wagons, each train carrying approximately 1,000 tons of ore. The trains enter the works from the Wishaw Deviation Branch at the north-east corner of the plant and discharge into the ore trough at the east side of the ore stockyard without uncoupling.

A 25-ton ore bridge transfers the ore from the "incoming" trough to stock at a maximum rate of 800 tons/hour. The ore is then loaded into the transfer cars which convey it to the reclaims hopper and thence to the screen house for grading before passing it to the furnace bunkers.

Limestone is discharged by wagon tippler and conveyed by belt conveyor to a super-elevated bin, and



Aerial view of the new Ravenscraig steel works

coking coal is set on the gravity sidings and the wagons pass through the coal tippler. There are ten blending bunkers, each of 500 tons capacity.

The coal crushers are of the centrifugal hammer type, there being two mills each capable of passing 260 tons/hour crushing 90 per cent to under ¼in.

There are 70 Becker type combination gas coke ovens, built in two batteries each of 35 ovens. Each oven has a cubic capacity of 732 cu ft or 15·69 tons of washed, crushed coal. The ovens are equipped with the usual machines: combined leveller, pusher and door extractor, clay carriers, coke side door extractor, and coke guide, and a coke quenching car with an electric locomotive.

There are two 75 tons/hour primary vibratory screens, one as a spare, each mounted on wheels running on a track laid within the screenhouse to enable the screens to be interchanged quickly.

The blast furnace (25ft 9in hearth diameter) has a rated output of 1,000 tons per day.

About 6,000 gallons of water per minute is circulated to the blast furnace and the stove valves, and quantities of the return are bled to meet the process and cooling requirements at the sinter plant, for pig quenching at the casting machines and for make-up to the gas plant. The furnace is equipped with double charging skips of 220 cu ft capacity each. These will deliver to a rotary distributor specially developed for a furnace operating on high top pressure.

The main power supply to the furnace is at 440 V a.c. and the ancillary equipment, including the stove burners, clay gun, etc., is supplied through three 1 MVA 11,000/440 V transformers.

The charging skip winch is driven by two d.c. 230 V 110 h.p. motors arranged for series-parallel operation and they receive power through two 900 kW rectifiers which also feed the ore bridge crane and scale and transfer cars. Adequate interlocking has been provided between a.c. and d.c. circuits.

The melting shop houses 800 ton inactive mixers and 200 ton fixed open hearth furnaces to give an initial output of 400,000 tons per annum. Hot metal is introduced at stage level in the furnace bay. The 75-ton capacity hot metal containers are lifted by a 135-ton crane and the metal is emptied into the mixers. By the same crane the hot metal is transferred from the mixers to the furnaces in 75-ton capacity transfer ladles. Scrap charging is effected by means of two floor type non-rotating 10-ton charging machines.

In the power station there are four bi-drum type boilers, each having a maximum continuous rating of 125,000 lb/hr. The normal fuel is blast furnace gas having a gross calorific value of approximately 98 B.Th.U/cu ft. There is a 100 per cent stand-by of oil having a gross calorific value of 18,000 B.Th.U/lb for use in the event of non-availability of blast furnace gas. Provision has been made for future operation on solid fuel comprising a 50/50 sandwich of Scotch bituminous slack and coke-breeze.

The boilers serve three turbo-alternators of 10 MW m.c.r. Two operate on steam at 400 lb/sq in and the third set is modified to take steam from the melting shop waste heat boilers at 250 lb/sq in, 700 deg F, and is capable of generating 8 MW.

The station is to run in parallel with the South of Scotland Electricity Board's 33 kV supply from which substantial power requirements in excess of the works generating capacity will be taken. 33 kV switchgear has been installed for distribution of this power throughout Dalzell Works, Lanarkshire Steel Works and Clyde Alloy Steel Works, all of the Colville Group.

Nuclear Patent Action Settled

A JOINT statement was issued on 31st July by Philips Electrical, Ltd., and the United Kingdom Atomic Energy Authority announcing the settlement in the High Court between the two parties of the action arising out of the late Professor Fermi's nuclear energy patent (United Kingdom Patent 465,045).

This patent is based on an invention made by Professor Enrico Fermi and his collaborators working in Rome in 1934, who discovered that neutrons slowed down by collisions with light atoms were more effective than fast neutrons in the process of producing radioactive elements. The basic Italian patent was applied for in that year. Full title and all rights to the invention for most countries other than the United States of America were subsequently acquired by the Philips organisation, and the registered owners of the United Kingdom patent are Philips Electrical, Ltd.

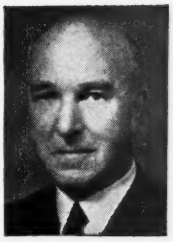
Since 1948 there have been discussions between the patentees and the Atomic Energy Research Establishment in which Philips urged that the position concerning the patent should be clarified, but as these discussions did not lead to any agreement, the patentees caused a writ to be served on the Atomic Energy Authority in March, 1956, alleging infringement of the patent. In April, 1956, the patentees also presented to the High Court of Justice a petition for extension of term of the patent. However, as the parties felt that it was preferable to settle these matters in an amicable manner, it has been possible to arrive at a compromise.

The statement says:—"The Authority have been conscious of the great contribution made to the advance of nuclear science by Professor Fermi's remarkable discovery, and also of the valuable development work in the nuclear field which has been carried out by Philips in conjunction with the Atomic Energy Research Establishment at Harwell. On the other hand, Philips has been anxious to avoid causing any interference with the development of nuclear projects in the United Kingdom."

The terms of the settlement include the withdrawal of the petition for extension, and an undertaking by Philips to secure that no claims will be made for the infringement of any corresponding patents abroad owned or controlled by any associated company of Philips in respect of articles and materials exported by the Authority or any of the companies engaged in association with the Authority in the nuclear power programme. In return for these concessions the Authority are paying a sum to Philips.

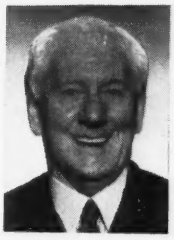
The settlement referred to was the subject of an order made by Mr. Justice Lloyd-Jacob. At the hearing on 31st July the following were represented as objectors to the petition for the extension of the patent:—The Central Electricity Authority, the English Electric Co., Ltd., the General Electric Co., Ltd., the A.E.I.-John Thompson Nuclear Energy Co., Ltd., and C. A. Parsons & Co., Ltd. All the opponents agreed to the dismissal of the petition.

Sir Henry Self

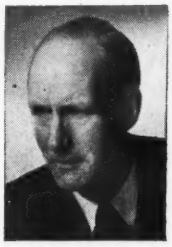


Sir Josiah Eccles

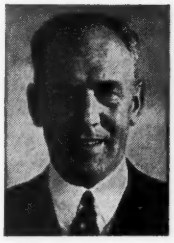
Prof. R. S. Edwards



Lord Citrine



Sir Christopher Hinton



Mr. C. R. King

Mr. F. H. S. Brown

Lt.-Col. E. H. E. Woodward

Mr. E. Long

New Electricity Authorities

FIRST APPOINTMENTS TO COUNCIL AND GENERATING BOARD

IN a written answer in the House of Lords last week to Lord Lucas of Chilworth, who asked whether any appointments had yet been made to the Electricity Council and Central Electricity Generating Board to be constituted under the Electricity Act, 1957, the Minister of Power, Lord Mills, replied that he had appointed the following members of the new Authorities with effect from 1st September next:—

Electricity Council: Chairman, Sir Henry Self, K.C.B., K.C.M.G., K.B.E.; deputy chairmen, Sir Josiah Eccles, C.B.E., M.M., and Professor R. S. Edwards.

Central Electricity Generating Board: Chairman, Sir Christopher Hinton, K.B.E., F.R.S.; deputy chairman, Mr. C. R. King, C.B.E.; members, Mr. F. H. S. Brown, B.Sc., M.I.Mech.E., M.I.E.E., and Mr. E. Long, F.S.A.A., F.I.M.T.A., F.C.I.S.

Lord Mills said that all these gentlemen would serve full-time with the exception of Professor Edwards. Lord Citrine had accepted appointment as a part-time member of the Electricity Council as from 1st January next, the day after the dissolution of the Central Electricity Authority. Further appointments to the two new bodies would be announced in due course. Lord Citrine is to continue as chairman and Lt.-Col. E. H. E. Woodward, C.B.E., as a part-time member of the Central Electricity Authority until the end of the year; their terms were to have expired on 14th August. The salaries of the two chairmen will be £10,000 a year; Sir Josiah Eccles and Mr. King will receive £7,500, Professor Edwards £2,000 (as part-time deputy chairman) and Messrs. Brown and Long £7,000.

A reply in the same terms was given by the Paymaster General, Mr. Reginald Maudling, to a similar question by Mr. F. W. Farey-Jones, in the House of Commons.

Sir Henry Self, who is sixty-seven, was appointed a deputy chairman of the Central (then the British) Electricity Authority in 1947. He was educated at Bancrofts School and at London University and entered the Civil Service in 1907, serving in various Government Departments before being appointed Permanent Secretary of the Ministry of Production in 1942. From 1943 to 1945 he served in Washington, becoming deputy chairman of the British Supply Council. He was Permanent Secretary of the Ministry of Civil Aviation from 1946 to 1947.

Sir Josiah Eccles, aged sixty, has been a deputy chairman of the Central Electricity Authority since 1953. He was born in Northern Ireland and served in France during the 1914-18 war, being awarded the Military Medal. After six years with the Metropolitan-Vickers Electrical Co., Ltd., he joined the Edinburgh Corporation Electricity Department in 1928 and was engineer and manager from 1940 to 1943 when he was appointed city electrical engineer of Liverpool. He was chairman of the Merseyside and North Wales Electricity Board from 1948 to 1953, and served as a part-time member of the British Electricity Authority during its first year, having previously been a member of the Organising Committee which planned the change-over to nationalised ownership. He is a past-president of the Institution of Electrical Engineers and of the British Electrical Power Convention.

Professor Edwards, who is forty-seven, was educated at Southgate County School and London University, where he graduated as Bachelor of Commerce. He was assistant lecturer and lecturer in business administration at the London School of Economics from 1935 to 1940 and served as Director of Labour and Assistant Secretary in the Ministry of Aircraft Production from 1940 to 1945. Since 1949 he has been Professor of Economics, with special reference to Industrial Organisation, in the University of London. He has served on a number of Government Committees, including the Committee of

Inquiry into the Electricity Supply Industry under Sir Edwin Herbert, from whose report the present reorganisation springs. He is a member of the University Grants Committee.

Sir Christopher Hinton (56) was educated at Chippenham Grammar School and Trinity College, Cambridge, where he had a distinguished academic record. He entered the service of Imperial Chemical Industries (Alkali Division) in 1926 and was chief engineer from 1931 to 1940, when he was lent to the Ministry of Supply. He was Deputy Director-General of Filling Factories from 1942 to 1946. He has been managing director of the Industrial Group of the United Kingdom Atomic Energy Authority since 1954 and a member of the board of the Authority for engineering and production. In this position he has been mainly responsible for the development of the Calder Hall "factory," the forerunner of commercial nuclear power plants in this country.

Mr. C. R. King (62), chairman of the East Midlands Electricity Board since 1948, was educated at Ilkeston Secondary School and Heaton Technical School. He served in the Army during the 1914-18 war in the ranks and as a commissioned officer. From 1940 to 1948 he was general manager of the Derby & Notts. Electric Power Co. and associated companies. He has served as a part-time member of the British Electricity Authority and of its successor, the Central Electricity Authority.

Mr. F. H. S. Brown (47) has been chief engineer of the Central Electricity Authority since the beginning of this year. He was educated at King Edward School, Birmingham, and the University of Birmingham, and received his training in the Birmingham Electricity Supply Department. He has had extensive experience of the design, erection and operation of generating stations since 1954.

Mr. Ernest Long (59) has been secretary of the Central (formerly British) Electricity Authority since 1951. He was educated at Carlisle Grammar School and served in local government posts. He was borough treasurer of Luton in 1935, of Finchley in 1936 and he became city treasurer of Newcastle-upon-Tyne in 1942. He served as deputy chief accountant, British Electricity Authority, from 1948 to 1951. He was secretary of the Institute of Municipal Treasurers and Accountants from 1944 to 1948, chairman of the Council, Institute of Public Administration, from 1949 to 1950 and he is a member of the Council of the Chartered Institute of Secretaries.

The New Organisation

Section 3 of the Act provides that the Electricity Council shall consist of a chairman, two deputy-chairmen and up to three other persons appointed by the Minister from amongst those appearing to him "to be qualified or having had experience of, and having shown capacity in, the generation or supply of electricity, industrial, commercial or financial matters, applied science, administration, or the organisation of workers." In addition the chairman of the Generating Board and two other members of that Board designated by that Board are to be members of the Council. The chairmen of the twelve Electricity Boards are *ex officio* members of the Council.

Section 2 of the new Act provides that the Generating Board shall consist of a chairman and from seven to nine other members, all to be appointed by the Minister from amongst persons qualified in the same manner as is provided for in the case of the Electricity Council.

The main duties of the Electricity Council will be to advise the Minister on questions affecting the industry; to promote and assist the maintenance and development by the Boards of an efficient, co-ordinated and economical system of electricity supply; and to scrutinise and advise on the Boards' capital programmes. The Council will also perform certain common services on behalf of the industry.

The Central Electricity Generating Board will be responsible for the development and maintenance of the main generating and transmission system for bulk supplies of electricity in England and Wales, including the programme for building between 5,000 and 6,000 MW of nuclear generating capacity to come into operation before the end of 1965.

ELECTRICITY SUPPLY SALARIES

New Scheme for Managerial Grades

A REVISED salary structure for managerial officers employed by the Central Electricity Authority and Area Boards has been introduced with effect from 1st November, 1956. There are eleven salary scales ranging from £1,500-£1,700 to £3,575-£3,800 and the additional allowance for London weighting has been increased from £50 to £60 per annum.

The new classification embraces five classes based in the case of Districts, Sub-Areas and Area Headquarters upon a "points" system, one point being allowed in respect of the following:—Each 10 million kWh sold; each 5,000 consumers; each 200 sq miles of area; and each £50,000 of contracting and sale of fittings. For power stations and Divisional Headquarters plant capacity is the basis.

It has been possible to agree fixed grades for most of the posts at Divisional Headquarters, for power station superintendents, for District managers and for Sub-Area posts. There are eleven grades. Grade 5 covers power station superintendents, District managers ("normal" Districts), Sub-Area commercial officers, accountants and secretaries (the last-named may, however, be included in Grade 4). Grade 6 covers Sub-Area engineers and Grade 7 District managers in "two-tier" Boards. At Divisional Headquarters the following fall into Grade 8:—Divisional secretary, Divisional accountant, technical engineer, generation engineers and system operation engineers. Chief generation engineers are included in Grade 11. Deputy chief engineers of Boards are in Grade 9 and Sub-Area managers in Grade 10.

No salary scales are specified for certain lower categories, but it has been agreed that the minimum shall be £1,500-£1,700 for any post at present covered by the N.J.M.C. agreement without prejudice to possible future arrangements. It is stipulated that minimum increases shall be applied, being £50 for posts at present on scales 1, 2 and 3, £75 for scales 4, 5 and 6, and £100 for scale 7 and over.

In the South of Scotland the classification scheme applies to Area posts and power station superintendents; the application of the scheme to Headquarters posts will be considered later. In the case of the North of Scotland the application of the scheme to all posts is to be considered later. Application in the North West, Merseyside and North Wales Division is also to be considered later, but in the meantime the scheme can be applied to designated posts as in normal Divisions.

VIEWS on the NEWS

By REFLECTOR

IT was reported in the *Electrical Review* of 19th July that the Metropolitan Boroughs Standing Joint Committee was taking up with the Government the question of the possible danger to street traffic of certain types of shop-window lighting. It was suggested by the Committee that legislation on the subject should be introduced—a suggestion which the *Electrical Review* regarded entirely without enthusiasm. Last week it was announced that Mr. Butler, the Home Secretary, had rejected the proposal. He said that the police were satisfied that shop-window lighting was rarely "dangerous" and that invariably those responsible were ready to make the necessary alterations. Therefore local action was all that was necessary. I think that, quite apart from "danger," there is still room for the education of shopkeepers in the correct methods of lighting their windows.

* * *

From time to time people in the Scottish Highlands bewail the desecration of the scenery by the North of Scotland Hydro-Electric Board, but always the Board finds its champions who rush to its aid. There has recently been correspondence in *The Scotsman* on this subject. One writer says:—

> "After a few years, the appearance of concrete mellows and spoil tips become more or less camouflaged with growth . . . and the various sections of the project blend in with the scenery. . . . After all, who can gainsay the attraction which Pitlochry Dam holds for tourists, a dam which was as usual condemned before its construction and is now listed as one of the local attractions."

In fact the Board is actually *making* not marring amenities.

* * *

One day last week the *Manchester Guardian* published an industrial catering supplement containing articles on the provision and running of staff canteens. Regrettably, the electrical aspect was not very prominent. The advertisements interspersed with the text included a half-page from the gas industry, but electricity supply was unrepresented. An amusing item, in such surroundings, was an announcement by a concern dealing with luncheon vouchers which claimed that these were "Better than a Canteen for your Staff."

* * *

The subject of the length of flex to be attached to domestic electrical appliances has been raised again by the North Western Electricity Consultative Council. It seems to be the view of some of the members that the flex usually provided is too short and it is suggested that if manufacturers omitted it altogether the retailer could fit the amount specified by the customer. Generally the desire for great lengths of flex is a reflection of the inadequacy of most electrical installations. Much as the use of yards of trailing wires is to be deplored, it is often the only means of obtaining full use of appliances. Mr. A. O. Johnson, chief commercial officer of the North Western Board, has told the Council that while it had been decided that the minimum length of flex was desirable, the length should be sufficient to obviate the necessity for increasing it, which often involved danger.

* * *

It may happen in the United States but I have never heard of it occurring here. *Aluminium News* (Montreal) says:—

> "People who have suspected their electricity meters of running too fast can take some consolation in the fact that they may be right. It appears that lightning bolts and heat waves can cause some meters to run as much as 15 per cent fast."

The journal goes on to say that the supervisor of meters for the Duquesne Light Co., Pittsburgh, has devised an inexpensive drawn aluminium shell which prevents this from happening. The shell "slips easily under or over the glass of a home-installed meter to protect damping magnets from sudden large currents that surge from a nearby lightning strike." With the shield, it is said, the current is forced through the aluminium which then sets up an opposing magnetic field, neutralising the surge effect.

* * *

Like many other developments which are regarded as of fairly recent origin, "district heating" is by no means a new idea. Sixty years ago (13th August, 1897) the *Electrical Review* recorded that the Danville Electric Light & Power Co., Ltd., an American concern,

> "have 2,000 feet of street mains of from 6 inches to 12 inches diameter covering the principal business street and serving 15 business blocks including the Government building, court house, and one hotel. The system was in use last winter with satisfaction. During the day two engines of 125 h.p. are at work, and at night more steam is produced than can be used because of the light engines. About a million and a half or two million cubic feet of space are thus heated. The Holly system is described as one of the best, and it is said that where the day and night loads are of fair proportions, the sale of the exhaust steam will pay fuel charges, water rents, and boiler room expenses. Boilers producing 100 h.p. will heat a million feet of space and bring in from $3,000 to $5,000 annually. The exhaust can be let off at about 5 lb above atmosphere, and as the system grows there is no need to stop at using waste steam. It will pay to sell direct steam as done by the New York Steam Heating Company."

PERSONAL AND SOCIAL

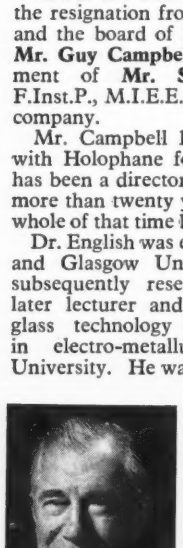
News of Men and Women of the Industry

The Minister of Power has appointed **Sir Anthony Bowlby,** Bt., of Edgbaston, Birmingham, as a part-time member of the Midlands Electricity Board. Sir Anthony is a director of Guest, Keen & Nettlefolds (Midlands), Ltd., and is general manager of the Screw Division of Guest, Keen & Nettlefolds. He is also a director of other companies.

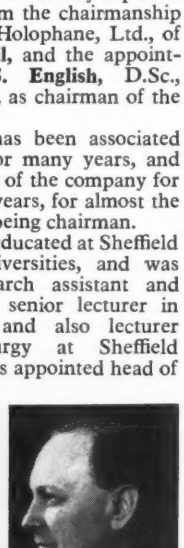
In our last issue we briefly reported the resignation from the chairmanship and the board of Holophane, Ltd., of **Mr. Guy Campbell,** and the appointment of **Mr. S. English,** D.Sc., F.Inst.P., M.I.E.E., as chairman of the company.

Mr. Campbell has been associated with Holophane for many years, and has been a director of the company for more than twenty years, for almost the whole of that time being chairman.

Dr. English was educated at Sheffield and Glasgow Universities, and was subsequently research assistant and later lecturer and senior lecturer in glass technology and also lecturer in electro-metallurgy at Sheffield University. He was appointed head of



Mr. Guy Campbell



Dr. S. English

the Research Department of Holophane, Ltd., in 1927, and became technical director in 1936, deputy managing director in 1946 and joint managing director in 1949. He resigned as technical director and joint managing director in 1955 on being appointed vice-chairman of the company. He was president of the Illuminating Engineering Society for 1937-38, and of the Society of Glass Technology for 1942-44. He is vice-chairman and hon. treasurer of the National Illumination Committee, and is also a director of the Société Anonyme Holophane, Paris.

Mr. J. F. Herbert has been appointed to the newly created post of manager, overseas atomic projects, with the English Electric Co., Ltd. He has also been elected a director of the English Electric Export & Trading Co.

Mr. Herbert, who was formerly the company's export area manager for Australasia and the Far East, was educated at Merchant Taylors' School and Sydney Church of England Grammar School. After taking a Bachelor of Engineering degree at Sydney University, he joined the English Electric Co. in 1930 as a graduate apprentice and served his time in the heavy electrical plant works at Rugby and Stafford. After a period as personal assistant to Mr. J. Bissett, who was then general manager of works, and further training on the staff of the Edinburgh branch office, Mr. Herbert worked for a year as the company's representative in the eastern counties. At the end of 1934 he was sent out on a sales mission for six months to West Africa and, after further service in London, was appointed the company's technical representative for Malaya in 1936. On the outbreak of war he was commissioned in the local volunteer forces in Malaya, and was taken prisoner in Singapore in 1942. He returned to this country in 1945, and went out again to Singapore in 1947 as manager (Far East) for the company, in which post he remained until 1953 when he returned to the United Kingdom on his appointment as export area manager for Australasia and the Far East.

Mr. T. C. Cleveland, formerly export shipping manager of E. K. Cole, Ltd., has been appointed acting manager, Export Department. **Mr. D. G. F. Farmer,** formerly assistant to Mr. Cleveland, has been appointed acting export shipping manager.

Mr. H. L. Dawe, chairman and managing director of the South African company of Johnson & Phillips, Ltd., has expressed a wish to retire from the latter office to enable his co-director, **Mr. E. H. Bennett,** to be appointed as managing director. Mr. Dawe and Mr. Bennett have been closely associated since the foundation of Johnson & Phillips South Africa (Pty.), Ltd. Accordingly Mr. Bennett will take over the duties of managing director of Johnson & Phillips South Africa as from 1st September. Mr. Dawe will continue as chairman of the company and also as a director of its associated company in the Central African Federation, Curling & Co. (Pvt.), Ltd.

Mr. W. H. McFadzean, chairman and managing director of British Insulated Callender's Cables, Ltd., and chairman of the Federation of British Industries' Advisory Council dealing with retired senior officers for industry, has been appointed a member of the Board which the Minister of Labour and National Service has set up, under the chairmanship of Sir Frederic Hooper, to advise on measures for assisting ex-regular officers and other ranks to find suitable employment on leaving the Forces.

Mr. P. W. Cash, B.Sc.Eng., A.C.G.I., M.I.E.E., system design and development engineer of the Central Electricity Authority, who, as briefly announced in our 26th July issue, has been appointed system operation engineer at headquarters, received his general education at Malvern College and his technical education at the City and Guilds (Engineering) College. After practical training with the Metropolitan Electric Supply Co., Ltd., he went to Malaya in 1928 in the employment of the Perak River Hydro-Electric Power Co., Ltd. He returned to England in 1932 and joined the Central Electricity Board with which he served successively as section engineer and control engineer in the South West England and South Wales area, assistant engineer (operation department), chief assistant operation engineer at head office and operation engineer in the Central England Area. With the establishment of the C.E.A. Mr. Cash became assistant operation engineer of the Midlands Division, but returned to London early in 1949 as engineer responsible to the system operation engineer. In this capacity he was concerned with the preparation of generating plant extension programmes and the basic planning of the 275 kV supergrid. After a short period in 1951 as special engineering assistant to the chief engineer, he became technical executive assistant to the deputy chairman (operations). He took up his present post in February, 1955.

Mr. P. W. Cash

Mr. G. M. Daniels, general manager of Southern Areas Electric Corporation, Ltd., who recently underwent an operation, informs us that he is now convalescent and will return to business shortly.

In reporting in our issue of 19th July presentations to **Mr. H. T. Taylor** upon his retirement we said that he had been responsible for the testing of the products of Premier Electric Heaters, Ltd. Actually, we are now informed, Mr. Taylor was for many years chief of the technical staff of

Premier Electric Heaters and in that position was responsible for research and was closely associated with design and development.

The London Electric Wire Co. & Smiths, Ltd., has announced the appointment of **Mr. T. Reed** as assistant sales manager at its Leyton factory. Mr. Reed has been succeeded at the Bristol branch, where he was branch manager, by **Mr. W. J. Jones. Mr. F. Foulkes** has been appointed branch manager at Manchester in succession to **Mr. L. Coope** who is now assistant sales manager of the associate company, the Liverpool Electric Cable Co., Ltd.

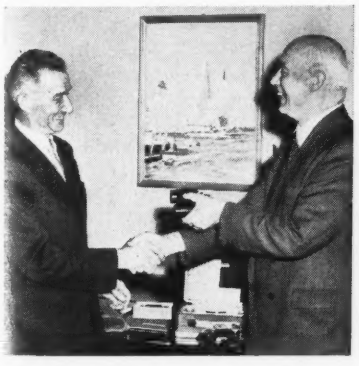
Mr. A. W. Evans, who was recently appointed branch manager of Brown Brothers, Ltd., Southampton, previously served the company as a representative in London and the Home Counties and latterly as assistant branch manager, Birmingham.

The Telegraph Construction & Maintenance Co., Ltd., announces the appointment of **Mr. J. L. Woollett,** A.M.I.E.E., A.M.I.Mech.E., as manager of its London branch at Mercury House, Theobald's Road, W.C.1. **Mr. F. T. Walker,** A.M.I.E.T., has been appointed manager of Telcon's Nottingham branch at Potter's Buildings, Warser Gate, in succession to Mr. Woollett.

We are informed that **Mr. W. C. Kennett,** B.Sc., M.I.E.E., A.M.I.C.E., of the Bryce Electric Construction Co., Ltd., is making a satisfactory recovery after undergoing a major operation in the Sutton and Cheam General Hospital.

Mr. A. L. Mounter, who has been the chief buyer of C.V.A. Jigs, Moulds & Tools, Ltd., for several years, has resigned with effect from 31st August.

Mr. E. Bates, deputy chief commercial officer of the Eastern Electricity Board, was presented with a pair of binoculars, a camera and a portable radio set at the Board's headquarters at Wherstead recently on the occasion of his departure to Newcastle where he will take up the position of chief commercial officer of the North Eastern Electricity Board. The presentation was made, on behalf of the staff, by Mr. C. T. Melling, the chairman of the Eastern Board.



Mr. E. Bates (left) receiving presentations from Mr. C. T. Melling

Mr. H. J. Unwin has been appointed manager of the Thurrock District of the Eastern Electricity Board in succession to the late Mr. E. K. Richardson.

Mr. Unwin commenced his electrical career in 1932 when he became an engineering apprentice at Rugby with the British Thomson-Houston Co., Ltd., with which company he subsequently became a research engineer. In 1940 he was commissioned in the Royal Naval Volunteer Reserve as a lieutenant (E). After the war, Mr. Unwin joined the Cambridge Electric Supply Co., Ltd., as sales engineer and upon nationalisation of the industry in 1948 he was appointed to the Fens Sub-Area of the Eastern Electricity Board as a senior assistant commercial engineer; at the beginning of 1951 he went to the headquarters of the Board at Wherstead as an assistant commercial engineer and two and a half years later was promoted to senior assistant.

Mr. J. F. Perrin, A.M.I.E.E., has retired from the Air Ministry on reaching the age limit, after nearly twenty-one years' service in the A.I.D. and Aeronautical Inspection Service. Mr. Perrin was educated at St. Dunstan's College, Catford, and received his technical training at Finsbury Technical College and Regent Street Polytechnic. He joined the Post Office Engineering Department in 1911, and during the 1914-18 war served first with the London Electrical Engineers R.E. (T), then with the Inns of Court O.T.C., later receiving a commission in the 12th London Regt. He subsequently served in Egypt and Palestine. On demobilisation in 1919 he joined Johnson & Phillips, Ltd., and was engaged for thirteen years on laying trunk telephone cables in many parts of the country. In 1936 he joined the A.I.D., and in 1946 was transferred to the Aeronautical Inspection Service. Before leaving he was presented with a folding camera by his colleagues in Carlisle.

The Royal Society announces that awards of grants by the Paul Instrument Fund Committee have been made as follows: £2,075 to **Dr. E. T. Hall,** senior research officer at the Research Laboratory for Archæology and the History of Art, Oxford, for the construction of an apparatus with which magnetic measurements may be made of archæological material and for the development of an instrument for applying the method of neutron activation analysis to archæological problems; and £2,600 to **Dr. C. N. Smyth** and **Mr. F. Y. Poynton,** working at the Northampton College of Advanced Technology, London, for continuation of the construction of an ultrasonic microscope for which a grant was made in December, 1954.

The Paul Instrument Fund Committee, composed of representatives of the Royal Society, the Physical Society, the Institute of Physics and the Institution of Electrical Engineers, was set up in 1945 to receive applications from British subjects who are research workers in Great Britain for grants for the design, construction and maintenance of novel, unusual or much improved types of physical instruments and apparatus for investigations in pure or applied physical science.

OBITUARY

Mr. T. McCulloch, works manager of A. Reyrolle & Co., Ltd., died on 30th July at the age of fifty-two, after a period of ill-health. Mr. McCulloch joined A. Reyrolle & Co. in 1949 after serving in a similar capacity with Ferguson, Pailin, Ltd., with whom he had been for twenty years, apart from a short period with Lancashire Dynamo & Crypto, Ltd., as production manager. Before this he had had experience with James Howden & Co., Ltd., with whom he served his apprenticeship, the Anderson-Grice Co., Ltd., and the Dunlop Rubber Co., Ltd. Mr. McCulloch was a prominent member of the Institution of Production Engineers, having served as chairman of the Newcastle-upon-Tyne Section for 1954-55, during which period he was also north regional chairman.

Mr. L. K. Brindley, consultant to the president of the International Nickel Co. of Canada, Ltd., died on 29th July at the age of seventy. At his retirement last February Mr. Brindley was deputy chairman of the Mond Nickel Co., Ltd. He joined Mond in 1948, following his resignation from the Falconbridge Nickel Co., Ltd., of which company he had been president. He became a director of Mond in December, 1948, managing director in January, 1951, and deputy chairman in May, 1955. At the time of his death, Mr. Brindley was a director of the Anglo Metal Co., Ltd., and also deputy chairman of the Council of the Copper Development Association.

WILLS

Mr. E. Ll. Morcom, formerly managing director of Belliss and Morcom, Ltd., who died on 23rd April, left £141,420 gross (£139,706 net).

Mr. G. M. Walker, M.I.Mech.E.. M.I.E.E., deputy general manager (technical) to the Perak River Hydro-Electric Power Co., Ltd., who died on 12th November last, left estate in Great Britain valued at £4,721.

Mr. F. M. Jones, M.I.Mar.E., M.I.N.A., A.M.I.E.E., representative of W. H. Allen, Sons & Co., Ltd., who died on 18th February last, left £46,142 gross (£46,079 net).

Mr. C. E. Lee-Jones, Derby district engineer, East Midlands Electricity Board, who died on 3rd March last, intestate, left £6,741 gross (£6,681 net).

Mr. R. A. Weaver, O.B.E., M.I.E.E., formerly of the Engineer-in-Chief's Office, G.P.O., London, who died on 26th January last, left £3,849 gross (£3,780 net).

Above: "Feus Hoose," Perth, showing (left) the public bar and (right) the "all-electric" kitchen

All-Electric Public House

ONE of the most modern public houses in Scotland, which was opened in May this year, is the "Feus Hoose," Crieff Road, Perth, and apart from one coal fire in the manager's quarters it is an all-electric building. The architect responsible for this three-storey building, which cost about £40,000, was Mr. R. C. Carvell, L.R.I.B.A.

On the ground floor are two bars. The larger of these, the public bar, has four 2 kW and two 1 kW wall-mounted electric convectors (Belling) which are thermostatically-controlled, and four electric fans (Vent-Axia). Refrigerated shelves keep the bottled beers cool, and an electric clock (Smith's) and television set (Ekco) add to the amenities of the bar which is adequately lit in contemporary style. Next to this bar is the Brahan Lounge, which contains two 2 kW heaters (Belling) and two extractor fans (Vent-Axia). Here again the bottled beer is kept cool by a refrigerated shelf and there is also a compartment next to the shelf for making ice cubes. The refrigeration unit (Prestcold) is located in the cellars. The lounge is lit in an attractive manner and contains an electric clock. Also to be found in the cellar is the boiler which supplies hot water for the whole premises. The water is heated by means of two 4 kW immersion heaters (Duncan Low). Here, too, is the pump which takes the draught beer up to the bars, driven by an electric motor (Crompton Parkinson) and the cellar is provided with two spare socket outlets.

Both of the toilets are supplied with hot water from the main system and are warmed by a thermostatically-controlled tubular electric heater. The vestibule and landing each have a 2 kW electric convector heater (Belling). The dance hall and annexe, on the top floor, is electrically heated, containing five 2 kW heaters (Belling), while there is special lighting above the small stage. A committee room has an electric heater (Belling) and a spare socket outlet. The provision of an adequate number of socket outlets is, in fact, a feature of the building. Every room in the premises has one, two or three socket outlets according to size.

Many functions will be held in this public house, and to cater for them there is an all-electric kitchen on the top floor. This contains an electric cooker, hotplate and tea urn (all G.E.C.), fluorescent lighting (Ekco) and an extractor fan (Vent-Axia). There are three spare sockets and more electrical equipment will be added as the kitchen comes into use.

The manager is Mr. J. Johnstone, and with his wife he occupies premises on the lower ground floor. Here there are three bedrooms, a lounge and a kitchen, and apart from the one open fire in the lounge the flat is all-electric. In the kitchen, for instance, is an electric cooker (Creda), a toaster and an electric fire.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 17th August:

DEBONETTE. No. 764,367. Class 7. Machines for the washing, drying and ironing of clothes, dish-washing machines, and machines for the mixing and the preparation of foodstuffs.—Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.

SIMCAR. No. 756,330. Class 8. Electrical apparatus and instruments; talking machines and calculating machines; electrostatic precipitators and parts; and radio sets and television sets, etc.—Simon-Carves, Ltd., Bird Hall Lane, Cheadle Heath, Stockport.

LUMOPHON. No. 750,492. Class 9. Radio receiving apparatus, television receiving apparatus, television cameras, magnetic sound recording and sound reproducing apparatus, electronic measuring apparatus, and parts.—Grundig Radio-Werke G.m.b.H., Bayern, Germany. Address for service, c/o A. A. Thornton & Co., Napier House, 24-27, High Holborn, London, W.C.1.

No. 761,868 (design). Class 9. Radio transmitting and receiving apparatus; surveying and navigating apparatus and instruments; telephonic apparatus and instruments; measuring, calculating and checking (supervision) apparatus and instruments; and electric cables and insulated electric wire.—Société d'Etude et d'Application des Techniques Nouvelles Neo-Tec, Paris, France. Address for service, c/o Marks & Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

ECONOMATICS. No. 762,873. Class 9. Automatic electrically operated controls for use in the supervision of industrial machines.—Weir Economatics, Ltd., Beachley Road, Tutshill, Chepstow, Mon.

No. 762,878. Class 9. Electrical and scientific apparatus and instruments; and radio, optical, measuring and signalling apparatus and instruments.—Etablissements Pierre Carrier, Paris, France. Address for service, c/o H. W. Fitzpatrick & Co., 3, Gray's Inn Square, London, W.C.1.

DAIMON (design). No. 763,699. Class 9. Galvanic cells and galvanic batteries; flashlight signalling apparatus; radio receiving apparatus; and microphones; and parts.—Daimon-Werke G.m.b.H., Berlin-Reinickendorf, Germany. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

SKY QUEEN. No. 763,777. Class 9. Radio receivers.—The Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

HERDSMAN. No. 764,381. Class 9. Electrical apparatus for charging wire fencing.—Platnauer-Westwood, Ltd., 19, Northampton Street, Birmingham, 18.

CYCLONE. No. 764,587. Class 9. Electric vacuum cleaning apparatus and parts.—Phœnix Sales, Ltd., Winton House, St. Andrew Street, London, E.C.4.

ACOS. No. 764,607. Class 9. Radio, television, telegraphic and telephonic apparatus and instruments; measuring apparatus and instruments, etc.—Cosmocord, Ltd., Eleanor Cross Road, Waltham Cross, Herts.

EKCO. No. 763,921. Class 10. Electronic and nucleonic apparatus for medical and surgical purposes.—E. K. Cole, Ltd., Ekco Works, Priory Crescent, Southend-on-Sea.

INDUSTRIAL NEWS

Domestic Refrigerators and Taxation

Representatives of the domestic refrigeration industry have held several meetings with Mr. F. J. Erroll, Parliamentary Secretary, Board of Trade, and stated the industry's case for easement of the burdens imposed by purchase tax and hire purchase restrictions on sales of domestic refrigerators in the home market. There has been full discussion of the detailed information provided by the industry in support of its contention that such an easement would enable manufacturers to increase the volume of their exports. Mr. Erroll reaffirmed that purchase tax and restrictions on hire purchase were an integral part of the Government's credit policy and that no relaxation of that policy was justified at the present time.

Locomotives for China

Under this heading *The Times* publishes a despatch from its Peking correspondent who says that China is said to have "dire need" to electrify certain stretches of her railways and is interested in buying British electric and diesel locomotives. Officials of the Ministry of Railways said that a French trade mission would be visiting China in two months' time and would include railway experts, but that no contacts had been made with British firms for the purchase of railway materials since the relaxation of the embargo at the end of May. The railways are said to need 200 or 300 each of electric and diesel locomotives. China manufactures small electric locomotives of under 2,000 h.p., but has reached only the design stage of a 4,000-5,000 h.p. locomotive based on Soviet and German designs. The correspondent was told that the greatest present need was for standard gauge 4,000 h.p. a.c. locomotives.

British locomotive manufacturers, including the English Electric Co. and the North British Locomotive Co., have expressed their willingness to supply locomotives to China and have refuted the suggestion that they have made no contacts with the Chinese in this connection.

Engineering Unions' Conference

The annual meeting of the Confederation of Shipbuilding and Engineering Unions (the "little T.U.C.") is to be held this year at Hastings, from 13th to 16th August. The agenda is a surprisingly modest one, in view of the 40 unions affiliated to the Confederation. As last year, automation has a conspicuous place in the agenda. A long resolution from the Amalgamated Union of Foundry Workers wants automation to be "socially controlled." Among the five demands it makes are consultation at every stage, training for redundant workers in the new techniques at the expense of managements, and higher wages proportionate to the higher rate of production. Similar demands are made in a motion from the Electrical Trades Union, to which are also added demands for a shorter working week without loss of pay, an increase in holidays to three weeks without loss of pay, and the introduction of adequate superannuation and sick schemes. The Amalgamated Engineering Union has an amendment to delete these added demands.

Apart from the view that "the benefits of automation and nuclear power must not be diverted solely for higher profits and dividends but be shared not only by the workers in those industries in which these new techniques are applied but also by those in other industries and workers who have retired from industry," the motion of the Clerical and Administrative Workers' Union emphasises the need for education in automation and nuclear power. It suggests the provision, by local education authorities, "of courses in the theory and practice of these new techniques and demands that employers give facilities for existing personnel to attend such courses without loss of pay."

In a second motion, the Amalgamated Union of Foundry Workers calls for a greater degree of urgency in implementing the Confederation's Plan for Engineering.

Telephone Exchanges for Sudan

Siemens Edison Swan, Ltd., has obtained a contract from the Sudan Ministry of Communications for a network of three exchanges to serve the Khartoum-Omdurman area. The new exchanges, to be known respectively as Khartoum South, Omdurman and Khartoum North, will serve initially a total of 5,800 subscribers and will ultimately have a capacity of 20,000 lines. They will integrate with the existing Khartoum main exchange supplied by Siemens Brothers some time ago.

Toronto Subway Trains

A new 16 mm film, "Lightweight Trains for Toronto," was presented for the first time before an invited audience at the offices of the Aluminium Development Association on 1st August. The film, produced in collaboration with the Gloucester Railway Carriage & Wagon Co., Ltd., and the Toronto Transit Commission, is in full colour with running commentary. It opens with a brief impression of the Toronto Subway and then moves to the genesis of the project in the design office. The main part of the film is taken up with the production history of the aluminium car as it goes through the works, with diversions to the foundry at which the sliding doors were sand cast and to an extrusion plant. The last "shots" in this sequence show the exterior of the finished, unpainted, cars being coated with lanolin and windows and doors being boarded for transit as deck cargo across the North Atlantic. The film concludes with scenes from the Canadian side giving a variety of impressions of these cars.

The film, which is available for loan, runs for approximately twenty minutes.

Non-Destructive Testing of Materials

In view of the interest taken in the course on non-destructive testing organised by the British Council in 1956 it has been decided to organise a similar course offering a broad survey of work in progress in the United Kingdom on the development of non-destructive testing techniques and of the uses to which these techniques are being put in industry. The course will consist of a series of lectures, discussions and visits. On this occasion the main emphasis will be on the scientific background of non-destructive testing. This course is intended for overseas industrial technologists and university research workers in science and engineering. There are vacancies for 15 members who will be accommodated in centrally situated hotels. The fee is £42. Applicants resident in the United Kingdom should apply to the Director, Courses Department, British Council, 65, Davies Street, London, W.1.

Mobile Electrical Showrooms

The success of its first mobile electrical showroom put into service last year by Falk, Stadelmann & Co., Ltd., has led the company to put others into service and there are now four of these

The interior of one of Falk, Stadelmann's mobile electrical showrooms

vans touring all areas of the country. The interior of one of these showrooms is shown in the accompanying picture.

Pure Elemental Boron

Borax Consolidated, Ltd., are marketing crystalline elemental boron in the pure state (99·0 to 99·7 per cent) which is expected to be of great interest to the electrical and metallurgical industries, and also for certain nuclear energy applications. In 1955 the company announced pilot-scale production of two grades of amorphous elemental boron, one of 90 to 92 per cent and the other of 95 to 97 per cent purity, and since then it has been working towards the production of the pure element. The new product is far more inert than the finely divided amorphous material and has a low oxygen and nitrogen content, making it particularly suitable for incorporation into alloys.

Government Stocks of Zinc

The Board of Trade announced in December last that it was about to make arrangements for reducing its stocks of zinc. It has decided to sell about 27,000 tons in a period of not less than nine months beginning September next. The first sales will be of about 9,000 tons for delivery and pricing over the three months September to November. The disposal of the remaining 18,000 tons in two or more subsequent three-monthly periods will be the subject of further announcements. Of the 27,000 tons, about 9,500 tons will be offered for sale by open competitive tender. The tender for the three months period September-November will be for 3,200 tons. The remaining 17,500 tons will be offered to the original suppliers or their agents.

Swedish Gas-Turbine Plant

Sweden's first large-scale gas-turbine power plant is expected to be completed in October, 1958, and will be put into regular operation about a year later, reports the Swedish State Power Board. It will have a capacity of 40,000 kW and is to be installed at Västervik on the Baltic coast.

The new plant will largely be of an experimental character with a view to gaining experience of gas-turbine operation. The Västervik station will mainly be used at peak-load periods and in times of drought. The gas-turbine equipment will be supplied by STAL. Inexpensive boiler oil will be used as fuel.

Industrial Truck Agreement

An agreement is announced, operative from 1st July, whereby Clark Equipment International C.A. has become an equal partner with the Austin Motor Co., Ltd., and Crompton Parkinson in I.T.D., Ltd., which markets the "Stacatruc" fork lift and "Electricar" platform trucks. Under this agreement I.T.D., Ltd., will have available Clark patents, designs and technical experience covering a wide range of light and heavy duty fork lift truck equipment and straddle carriers. The industrial truck division of Clark has a wide and varied range of equipment covering petrol, diesel and electric fork lift trucks of the rider operated type, capable of carrying loads up to 50,000 lb, straddle carriers with comparable capacity, pedestrian controlled fork lift and platform trucks and a range of industrial towing tractors. The merger of British and American interests will result in the resources of Clark being added to those of the Austin Motor Co. in automotive engineering and to Crompton Parkinson in the design and manufacture of electrical equipment.

The reconstituted I.T.D. will take over from Austin Crompton Parkinson Electric Vehicles, Ltd., the manufacturing resources at the Hall Green factory and become responsible for the manufacture, sales and servicing of industrial platform and fork lift trucks. Factory extensions are proceeding at Hall Green to deal with the increased sales and expanded range which will result from this combination with world-wide interests. The new constitution of the board of I.T.D., Ltd., is as follows:—Messrs. J. V. Daniel (managing director, Crompton Parkinson, Ltd.), G. W. Harriman, C.B.E. (deputy chairman, Austin Motor Co., Ltd., British Motor Corporation), M. H. L. Lewis, M.A. (managing director, Crompton Parkinson, Ltd.), G. T. Sammons (partner, Messrs. Allen & Overy), W. E. Schirmer (U.S.A.) (vice-president, Clark Equipment Co.) and S. J. Wheeler (director, Austin Motor Co., Ltd.).

C.E.A. Contracts

Contracts have been placed by the Central Electricity Authority during the past month for power stations, transforming stations and transmission lines amounting in the aggregate to £7,761,400. The principal contracts include the following:—

Drakelow "B" power station, Burton-on-Trent: Foundation extension.—M. J. Gleeson (Contractors).

Spondon "H" power station, near Derby: Structural steelwork.—Edward Wood & Co.

Elland power station, Yorks: 415 V switchgear.—English Electric Co.

Skelton Grange "B" power station, Leeds: One 120 MW turbo-generator and feed water heating plant.—C. A. Parsons & Co. Condensing plant.—G. & J. Weir.

Padiham "B" power station, near Burnley: Two 120 MW reheat boilers.—Babcock & Wilcox.

Rheidol hydro-electric scheme: Access roads and preliminary works.—Sir Alfred McAlpine & Sons.

Carrington-Old Hall Road and Portishead-Churchill/Bridgwater and the Northfleet power station: 132 kV overhead lines.—W. T. Henley's Telegraph Works Co.

Belvedere substation, near Erith: 132 kV, 3·3 kV and auxiliary cables.—British Insulated Callender's Cables.

Yarmouth substation: 132 kV switchgear.—Metropolitan-Vickers Electrical Co.

Pyle substation: Site and foundation work.—George Wimpey & Co.

Southport substation: Two 60 MVA, 132/33 kV transformers.—Ferranti.

Crewe substation: Two 15 MVA, 132/25 kV transformers.—English Electric Co.

Bold "B" substation: Site and foundation work.—A. Monk & Co.

Hams Hall-Melksham: 275 kV overhead line.—British Insulated Callender's Construction Co.

Tilbury-Basildon: 132 kV overhead line.—J. L. Eve Construction Co.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £212 2s 6d
Fire Refined 99·70%	ton £211 0s 0d
Fire Refined 99·50%	ton £210 0s 0d
COPPER Tubes ..	lb 2s 1d
Sheet	ton —
H.C. wire and strip ..	ton £270 5s 0d
LEAD, English ..	ton £91 7s 6d
Foreign	ton £90 0s 0d
MERCURY	flask £87 0s 0d
TIN, block (English) ..	ton £742 15s 0d
ZINC, G.O.B. Foreign	ton £72 12s 6d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 8½d
Sheet	ton —
Wire	lb 2s 5½d
PHOSPHOR BRONZE Wire	lb 3s 8d
PLATINUM	oz £31 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 27½d—27¾d

Hotelympia, 1958

Plans for next year's International Hotel and Catering Exhibition at Olympia, London, from 22nd to 31st January, are nearing completion, and some 250 exhibitors have now booked stand space.

Hastings Tramways Bill

The Hastings Tramways Bill, which provides for the replacement of electric trolley-buses in the Hastings district by diesel buses, has received an unopposed third reading.

Insulated Wire Manufacturers' Coming-of-Age

F. D. Sims, Ltd., manufacturers of insulated wire and strip, are celebrating their coming-of-age this year. The company commenced in a small way in 1936 at Hazelhurst Works, Ramsbottom, and these works have been considerably extended to meet the increasing demand for its products. The company also has a subsidiary works in Bury for the processing of textile and glass covered materials. One way in which the company is marking its twenty-first year is by the registration of the "FDS" cipher, under which its goods have been sold since it commenced operations, as its trade mark.

All-Electric Canteen

A new National Coal Board canteen has just been completed at Newton

The all-electric kitchen at the N.C.B. Area headquarters, Newton Hill, near Wakefield

Hill, nr. Wakefield, Yorkshire, to cater for the Area headquarters and workshops staff. The kitchen and the dining room are housed in a new separate building of modern design and the whole of the all-electric cooking and serving equipment was supplied by Stotts of Oldham.

Nuclear Power in Belgium

The Westinghouse Electric International Co. announced in New York last week that it had signed an agreement to give technical information on the production of full-scale atomic power plants to Belgium's largest electrical manufacturer, Ateliers de Constructions Electriques de Charleroi (A.C.E.C.). The agreement, the company said, covered complete nuclear reactors and related apparatus and opened the way for A.C.E.C. to manufacture nuclear reactors of the pressurised water and other non-military types developed by Westinghouse.

The company also stated that it was building an 11,500 kW pressurised water reactor plant for the Société Co-operative Electronucleare, a Belgian firm, to be installed at the National Atomic Research Centre at Mol, near Brussels.—*Reuter.*

Instruments, Electronics and Automation Exhibition

The 1958 Instruments, Electronics and Automation Exhibition will be held from 16th to 18th April next at Olympia, London.

Aluminium Fusion Welds

A booklet intended to meet the needs of authorities who have cause to test welds and approve welders engaged on fabricating aluminium has recently been published by the Aluminium Development Association, 33, Grosvenor Street, London, W.1. In forming for this purpose a guide to the drafting of welders' specifications, it also draws attention to those characteristics of aluminium welds that are of importance in assessing the quality of welds and the competence of welders.

The booklet is divided into three parts: (1) a survey of current methods of testing welds, with notes on their application to welds in aluminium and aluminium alloys; (2) notes on making test welds; and (3) the characteristics of aluminium welds and defects which may occur in welds made by the four processes in use to-day, i.e. tungsten arc (Argon Arc), inert-gas metal-arc (Argonaut, Sigma, Aircomatic), oxy-gas and metal-arc. It is hoped that further parts will in due course deal with other aspects of the subject, such as the strength requirements of various types of joints.

New "Atlas" Company

Thorn Electrical Industries, Ltd., announces that in view of the continued expansion of its business in recent years, the whole of its lighting activities have been transferred to a fully owned subsidiary, Atlas Lighting, Ltd., with registered offices at 233, Shaftesbury Avenue, London, W.C.2. The new company will be responsible for the development, manufacture and sale of all "Atlas" tungsten filament and discharge lamps, including fluorescent tubes, electric light fittings and fluorescent control gear and accessories. The directors are as follows:—Messrs. A. Deutsch, A.M.I.E.E. (chairman), H. H. Ballin, Ph.D., B.Sc. (Econ.), F.I.E.S., J. G. Christopher, T.D., F.I.E.S., A. J. Ford, D. A. Neill, B.Sc., A. S. Shier, J. W. Strange, Ph.D., A.R.C.Sc., F.I.E.S., and G. J. Strowger (secretary). In addition to controlling the factories in this country the company will also control the overseas factories at Johannesburg, Melbourne and Auckland and all the other overseas activities in the lighting field. The commercial headquarters and London showrooms will remain at 233, Shaftesbury Avenue, W.C.2, and the addresses of the Accounts Department and of all London and provincial sales offices, order departments and warehouses will also be unchanged.

Batti-Wallahs' Society

The guest speaker at last week's luncheon of the Batti-Wallahs' Society was Sir Rex Hodges, managing director of the Merseyside Docks and Harbour Board, who spoke on the Battle of the Atlantic as seen from the office of the Board, in the course of which he revealed the many problems which arose during the war in connection with defence, the heavy calls made upon the port to accommodate naval vessels, convoys and merchant shipping, and the success which was achieved despite enemy action. Mr. T. C. F. Bigland (the "Mate") announced that, in accordance with custom, there would be no luncheon in August, the next function being on Thursday, 26th September, when the guest speaker will be Captain R. H. J. Wallis of the cable ship *Alert*.

E.P.E.A. Annual Dinner

This year's annual dinner of the Electrical Power Engineers' Association is to be held on 22nd November at the Connaught Rooms, London, W.C.2.

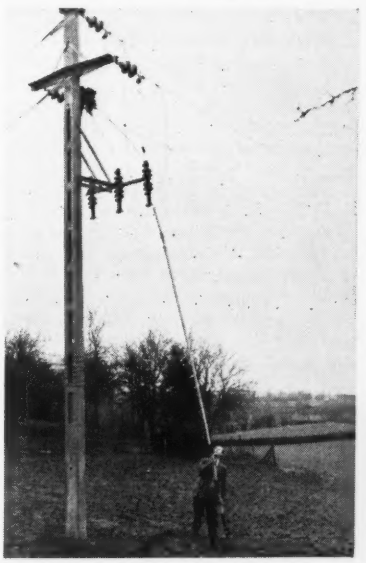
Transformers for Malaya

The Brush Electrical Engineering Co., Ltd., Loughborough, has received an order from the Central Electricity Board of the Federation of Malaya for equipment valued at over £60,000. The order was placed through the Crown Agents and is for sixty-eight distribution transformers ranging from 100 kVA to 1,000 kVA and two 4,000 kVA transformers fitted with Brush resistor type tap changers.

Overhead Line Maintenance

Glass fibre operating poles for fuse changing, earthing, isolating and live line tapping introduced recently by Permali, Ltd., of Gloucester, are designed to replace timber poles of the same, or greater, cross-section. The poles are manufactured from high strength, heat-cleaned fine weave glass fabric combined with specially prepared polyester resins which give an excellent combination of mechanical and electrical strength and resistance to moisture and weathering. As the material is non-conducting no addi-

Permali glass fibre operating pole in use



tional insulators are fitted to the pole, which consists of a bottom, top and one or more intermediate sections each 1½in in diameter and 14ft long. A 16ft (four-section) pole weighs about 4½ lb and can lift up to 14 lb without breakage. The pole is designed for all types of standard pole head fittings and, in cases where a special fitting cannot be attached directly to the top section, simple adaptors are available.

Insulators for Telecommunication

The specification "Ceramic Insulators for Telecommunication Purposes," prepared by the Radio and Electronic Component Manufacturers' Federation, has recently been revised by the Federation's Panel "R" and is published from 21, Tothill Street, London, S.W.1, price 1s.

Royal Military College of Science

The annual report of the Royal Military College of Science for the year 1955-56 has just come to hand. In the Commandant's report, which gives a general review of the year, it is interesting to note that in spite of the great pressure which has been brought to bear for reducing expenditure on the Armed Forces, it has been decided that present commitments should continue. A new advanced course in nuclear science and technology for technical staff officers will be open to the Royal Navy and the Royal Air Force.

Radio Hobbies Exhibition

The Radio Society of Great Britain has agreed to rename the Amateur Radio Exhibition to Radio Hobbies Exhibition, and to increase the scope and size of this annual show. The Royal Horticultural Old Hall, Vincent Square, S.W.1, has been reserved for this event. Sir Harold Bishop, technical director, engineering services, at the B.B.C., has consented to open the exhibition on 23rd October and the show will remain open until 26th October.

Preventing Road Icing

Experiments in the electric heating of roads to prevent icing have already been carried out and the Department of Scientific and Industrial Research proposes to conduct further experiments next winter with electric road-heating grids to determine the efficacy and cost of the method. It is believed that the cost will probably be not much more than that of present methods of dealing with iced roads and the electrical system can, of course, be brought into action before icing actually occurs.

National Industrial Safety Week

"Guard Your Hands" is the slogan for this year's national campaign which the Royal Society for the Prevention of Accidents is organising with the object of reducing the number of accidents in industry. The National Industrial Safety Week will be held from 30th September to 5th October. As with previous campaigns it will be directed mainly to managements, who during the week will be asked to do everything possible to encourage their employees to work safely. Support for the campaign will also be given by the local industrial accident prevention groups, who will be organising special functions, in some cases in co-operation with their local authority and Chamber of Commerce. To assist organisers of local campaigns the Society has prepared a comprehensive range of publicity material.

Hospital Equipment Exhibition

The first International Hospital Equipment and Medical Services Exhibition is to be held in the Empire Hall, Olympia, from 5th to 10th May next year. It is being sponsored by the Institute of Hospital Administrators which will hold its annual conference during the exhibition. The director and organiser of the exhibition is Mr. W. R. Kern, and details of the exhibition can be obtained from Contemporary Exhibitions, Ltd., 40, Gerrard Street, London, W.1.

Anglo-French Radar Co-operation

Compagnie Francaise Thomson-Houston (C.F.T.H.), of France, and Decca Radar, Ltd., England, announce that they have concluded an agreement by which both concerns will co-operate in the design and production of radar equipments for European air defence. They will make available to each other design details of certain equipments required for defence purposes. Arising from this co-operation an agreement has been concluded between Decca Radar, Ltd., and Société Nouvelle d'Electronique, an affiliated company of C.F.T.H., concerning radar aerial systems developed by the Societe RBV Radio-Industrie.

Trade Announcements

Mono Pumps, Ltd., have opened an office at 77, Great Victoria Street, Belfast. Mr. J. S. Harper, who is the manager of the office, has been responsible for this area for many years and is already well known to pump users in Northern Ireland. The new office will provide a convenient spares service to users in Northern Ireland.

The **Engineering & Lighting Equipment Co., Ltd.,** announces that Mr. L. V. Harvey, Birmingham area sales manager, who has previously covered Staffordshire, Shropshire and Worcestershire and part of Herefordshire, is now adding Warwickshire and Northamptonshire to his territory. Mr. L. A. Garner, area sales manager for South East London, will now be covering the whole of Kent and East Sussex in addition.

CABMA Register

The "CABMA Register 1957-58 of British Industrial Products for Canada," published jointly by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd., for the Canadian Association of British Manufacturers and Agencies, is now available from Iliffe & Sons, Ltd., at Dorset House, Stamford Street, London, S.E.1, price 15s, post free. Sir William Rootes, chairman of the Dollar Exports Council, says in his foreword to the fifth edition of the Register: "As a link between producer and customer the CABMA Register is a valuable aid to the exporter and in this fifth edition it appears in a rather different form. Experience has shown that it has proved of greatest value in the field of capital and industrial goods and it has now been decided to confine the Register to the names of British manufacturers of such products and their Canadian distributors." In this edition emphasis has been placed upon capital and industrial goods of British manufacture required by Canadian industry. All the information contained in previous editions including the extensive alterations in the telephone exchanges has been brought up to date.

The Buyers' Guide lists alphabetically some 3,200 British products available to the Canadian market, with their suppliers given under each heading. The French equivalents of these headings are set out in alphabetical order in a separate glossary. A directory of over 3,700 British firms gives details of their distribution arrangements in Canada, and further information about some of these firms and the products they supply is given in another section. Proprietary names and trade marks appear in special sections which enable the Canadian buyer to identify products and their sources of supply. The six sections of the Register are easily identified by the slotted index and the tinted paper, and instructions are given on the title pages of each section in French as well as English.

In addition to the message from Sir William Rootes there are also introductory messages from the chairman of the Dollar-Sterling Trade Council, Mr. J. S. Duncan, C.M.G., and the president of CABMA, Mr. H. G. McHaffie, in Canada.

The Register is the Canadian buyers' standard work of reference and the degree of completeness and efficiency attained by this edition has once again been made possible by the full co-operation of the following sponsoring organisations: the Dollar-Sterling Trade Council in Canada and, in the United Kingdom, the Dollar Exports Council, the Federation of British Industries, the National Union of Manufacturers and the Scottish Council (Development and Industry).

Canadian Electrical Industry

INCREASED IMPORTS DESPITE EXPANSION OF HOME MANUFACTURE

IN 1955 Canada ranked fourth to Australia, the United States and South Africa as an export market for United Kingdom goods, and although there has been considerable development of its secondary industries, this has been accompanied by an almost proportionate expansion in the Canadian market for imported goods. In his report on the economic and commercial conditions in Canada (H.M. Stationery Office, 11s 6d net), Mr. G. Bowen, United Kingdom Trade Commissioner in Canada, gives a comprehensive survey of the Canadian manufacturing and electricity supply industries, and indicates the types of plant and equipment for which there is a considerable demand. He says that the market for electrical goods should continue to expand, for although Canadian manufacture is increasing, the margin left for imports is likely to remain considerable in the aggregate, although highly competitive. While much of the statistical information given in the survey has been superseded from time to time by later information from other sources, the survey is nevertheless valuable as an indication of the general trend and development of the Canadian electrical industry.

Electrical Plant

An almost complete range of electrical goods for both industrial and household use is produced, the total production in 1954 being valued at $986·7 million. The Canadian electrical industry produces meters and instruments, industrial control equipment and telephone and telegraph apparatus, in addition to generators, switchgear, transformers and motors. It does not, however, produce steam turbo-generators of the larger type. The production of transformers is the most important section of the heavy electrical industry and accounted in 1954 for nearly one-quarter of the value of the total output of $208·1 million.

As was to be expected, the United States, with the advantage of close proximity, is the principal exporter of most electrical goods. The value of imports of transformers into Canada in 1955 was $6,595,000, of which nearly $5 million came from the United States; the United Kingdom's share was $981,000. In spite of considerable production of switchgear and protective equipment, Canada imported equipment valued at $11,431,000 in 1955, the United States' share being valued at nearly $9 million while imports from the United Kingdom amounted to $1,330,000. Although the United States is the principal source of motors imported into Canada, the United Kingdom increased its share of the market from 9·5 per cent in 1950 to 13·9 per cent in 1955.

While Canadian manufacturers increased their share of the market for hydraulic turbines, overseas producers (mainly British and European) obtained at least 20 per cent of the new contracts in the first six months of 1954 for large waterwheel generators and synchronous condensers. The United States' share of the imports of generators and parts declined between 1950 and 1955, but that of the United Kingdom rose from 38·4 per cent to 39·6 per cent. The relatively large United Kingdom share reflects mainly the demand for imported steam turbo-generator sets of the larger sizes.

In the miscellaneous group of apparatus, covering wire and cable, wiring devices, lighting fittings, lamps, batteries, and cut-outs and fuses, the bulk of the market is covered by Canadian manufacturers, and only a little over 11 per cent of the total is represented by imports. In all these classes the bulk of the imports come from the United States.

Radio and Electronic Equipment

Canadian manufacture of radio and electronic apparatus is the most rapidly expanding section of the electrical industry, the value of its output having more than trebled between 1950 and 1954. There is a considerable production of radar, micro-wave and telecommunication equipment and navigational aids, almost entirely for the armed services. The market for industrial electronic equipment is increasing rapidly with the growth of automatic controls, notably in oil refineries and in the chemical, steel, automobile, textile and aviation industries. United Kingdom exporters enjoy a price margin in this field as much as 40 to 50 per cent over United States' competitors, but an advantage even of this magnitude is liable to be nullified in Canadian conditions by extended delivery dates.

In the domestic appliance field the major appliance group covers the manufacture of refrigeration equipment, washing machines, and cookers and hotplates. During 1951 and 1952 imports of refrigerators increased, but they declined in the two years following, both absolutely and in relation to the proportion of the market supplied. Imports of washing machines came almost entirely from the United States.

The total value of production of small appliances, such as vacuum cleaners, electric clocks, shavers, air heaters, laundry equipment, water heaters, irons and toasters was estimated at $37·8 million in 1954. There has been a considerable increase in imports in recent years; those of electric irons rose in value from $194,000 in 1952 to $720,000 in 1955; and imports of electric shavers increased from $1,450,000 in 1952 to $3,600,000 in 1955. Although the United Kingdom and certain European countries have slightly increased their small share of the Canadian market, notably in irons, toasters and shavers, they remain the marginal suppliers and the major part of imports is supplied by the United States.

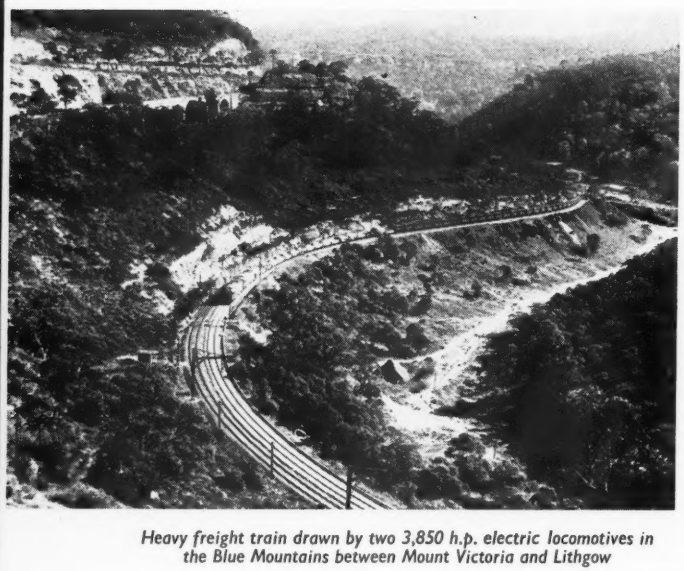
Hydro-Electric Development

Water power provides 95 per cent of the electricity generated in Canada. In Newfoundland, Quebec, Ontario, Manitoba and British Columbia, hydro-electricity is the major source of power. The total installed capacity in Canada (at the time of this report) exceeded 17 million h.p., a greater total than for any other country in the world except the United States. The installed capacity per head of population is second only to that of Norway. Projects scheduled or proposed for completion around 1965 total about 10 million h.p. Consumption exceeded 4,000 million kWh per month in 1948, passed 6,000 million kWh in 1953 and is expected to increase at at least this rate until 1960. Mr. Bowen gives details of some of the large hydro-electric schemes in course of construction or being investigated.

Dealing with atomic energy, Mr. Bowen says that in 1953 the Federal Government invited Canadian power

authorities to take part with Atomic Energy of Canada, Ltd., in researches directed towards the generation of electric power from nuclear energy, as a result of which proposals put forward by the Ontario Hydro-Electric Commission and by the Canadian General Electric Co., Ltd., were accepted for the construction of an experimental power station of about 20,000 kW capacity. The Ontario Hydro-Electric Power Commission will design and pay for the conventional part of the plant (turbine generator and transmission gear), operate the station on completion and feed the power into its grid. The Canadian General Electric Co. will be responsible for the detailed design and engineering of the reactor and will contribute $2 million to its cost. The experimental station is estimated to cost about $11 million and to be ready for operation in 1958.

New South Wales Railway Electrification



Heavy freight train drawn by two 3,850 h.p. electric locomotives in the Blue Mountains between Mount Victoria and Lithgow

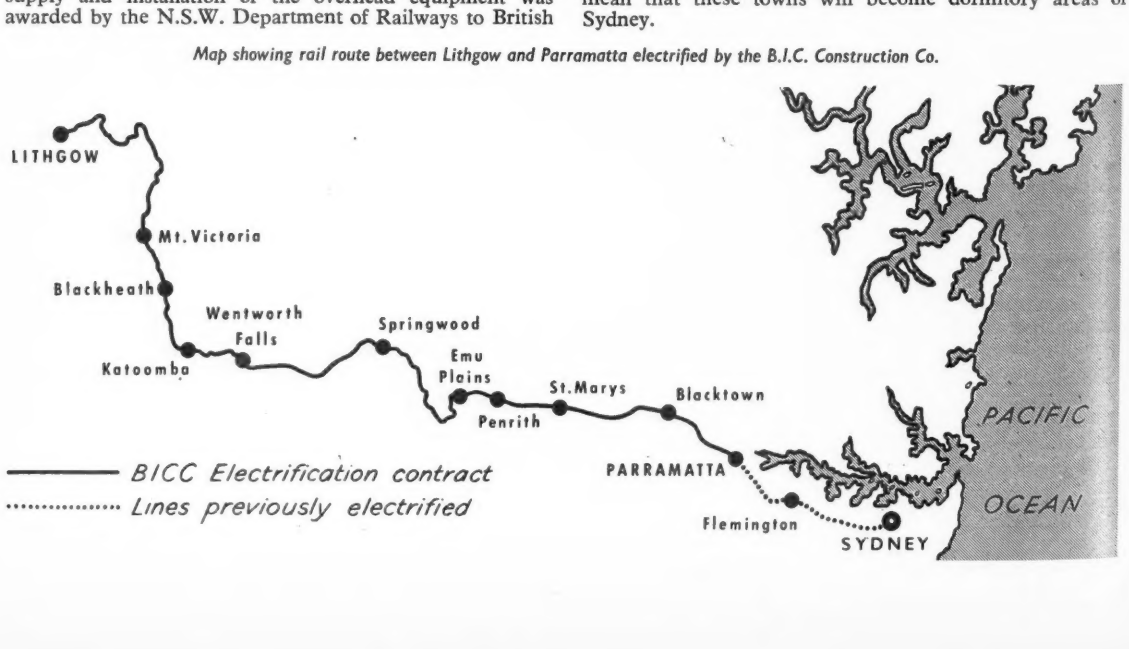
ELECTRIFICATION of the main line railway between Parramatta, near Sydney, and Lithgow, in the Blue Mountains, a distance of 83 miles, has been completed and was officially opened by the Premier of New South Wales, the Hon. J. J. Cahill, recently. The contract for the supply and installation of the overhead equipment was awarded by the N.S.W. Department of Railways to British Insulated Callender's Construction Co., Ltd., London, the work to be carried out in three stages. Stages 1 and 2 —Parramatta-Blacktown and Blacktown-Penrith—were opened for service in February, 1955, and September, 1955, respectively.

A 1,500 V d.c. system was selected for this scheme and stages 1 and 2 are of the simple catenary type. For stage 3, from Penrith to Lithgow, however, a compound catenary construction was used because of the heavy currents demanded by the nature of the route. In the Blue Mountains the track rises to a height of 3,500ft above sea level and gradients of up to 1 in 33 are encountered, while curves of down to 8 chains radius occur. These features presented special problems to the designers of the equipment and to the erection staffs in the field. The equipment for this scheme was designed by the B.I.C.C. Group in England and a team of experienced members of the traction staff of the Construction Co. went out from the United Kingdom to supervise the installation.

The equipment is supported in the main from portal structures fabricated in England from broad flange beams and a total of 7,000 tons of steel has been used. Most of the fittings were manufactured at the Prescot Works of British Insulated Callender's Cables and the wires were produced in Australia by Metal Manufactures, Ltd. These wires consist of 0·3 sq in cadmium-copper contact wires and stranded h.d. copper catenary wires. In all some 2,300 tons of copper has been used.

Electrification of this line will provide many advantages. The journey times between Sydney and Lithgow will be reduced by an hour for passenger trains and two hours for freight trains. In addition to providing fast freight services linking the mining and agricultural areas of the Blue Mountains with the eastern seaboard, a quick and frequent local service from Sydney to Blacktown and Penrith will mean that these towns will become dormitory areas of Sydney.

Map showing rail route between Lithgow and Parramatta electrified by the B.I.C. Construction Co.



Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

IN a previous article by the author, test data from one of the nine regional systems of Czechoslovakia were analysed and evaluated, by reporting the results obtained in two more regional systems and in the interconnecting grid. The data now given refer therefore to 100, 35, 22, 6 and 220 kV, so that the results, together with those previously obtained, may be taken to be representative of the whole national supply system. The measurements as well as their statistical evaluation were based on the principles adopted and recommended by the I.E.C. and C.I.G.R.E., and were carried out partly as short-circuit tests in the systems, and partly during operation, by a " recovery voltage indicator."

The special observations made in the Czechoslovakian systems are as follows: the steepest rates of rise occur in the case of short circuits close to transformers and reactors, unless the latter are connected through a cable with the clearing circuit-breaker. Steep rises also occur on breakers in outgoing lines in the case of short circuits fed only by the local sources of supply (generators and transformers), and on breakers in substations when short circuits at distances up to 10 km from the substation have to be cleared. As in other systems, the steepest rates of rise are not associated with the greatest short-circuit MVA. The recommendations for circuit-breaker testing are based not only on the results reported, but also on a careful analysis of similar comprehensive investigations carried out in Sweden, Switzerland, France, Great Britain, the U.S.A. and Japan.—" Results of Investigations of the Restriking Voltage in the Czechoslovakian Power Systems and Recommendations for H.V. Circuit-Breaker Testing Regulations," R. Gert, *Elektrotech. Obzor,* Vol. 46, No. 3, pp. 126-137, March, 1957, in Czech.

Life of Insulating Materials

Montsinger's law of the service life of Class A insulation, found empirically in 1930 and relating the life to an exponential of the service temperature in degrees C, was replaced in 1942 by a law of more general character, applying to other classes of insulation as well, and taking the form of an exponential function of the absolute temperature. This law was derived by Büssing from considerations of chemical kinetics and was confirmed by many experimental results. However, it was still based on the assumption of a constant ageing temperature and therefore still susceptible of further improvements. The author has extended the theory to include variable ageing temperatures.

This is done by defining a criterion of thermal stressing and by deriving the fundamental equations for the most important cases, viz. for linear and exponential temperature-time relations. These temperature relations are correlated with equivalent steady temperatures producing the same thermal stresses. This enables the calculation of the stresses set up by temperature cycles composed of periods at constant temperature and of periods of linear and exponential temperature variations in time to be based on the use of an addition theorem for piecewise constant temperature plots (a step curve).—" Calculation of the Life of Electrical Insulating Materials at Constant and Variable Ageing Temperatures," H. J. Frentz, *E.T.Z.(A),* Vol. 78, No. 4, pp. 156-161, 11th February, 1957, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

Submarine Cable Protection

The Japanese islands are an ideal proving ground for submarine cable connections, because the many smaller ones of the group have to be supplied from the larger main islands. As shipping and fishing are more important than for any other country of the world (on account of the population of almost 100 million crowded together in an area corresponding to that of the British Isles), the traffic and coastal fishing often endanger the submarine power cables, which traverse important fishing zones, and means of effectively protecting the cables against such potential damage have to be devised.

The authors' paper illustrates cases in question, viz. damage done to the longest of the Japanese submarine cables between the town of Niihama and Shisakajima island by fishing implements of a special kind, and its consequences. The methods of burying the cables in the silt at the sea bottom originally devised worked with a submarine plough creating a cable ditch about 1½ft deep, under the supervision of divers. Although the results obtained were quite good, an even more satisfactory method was developed, by which the laying-down and burying of the cable are carried out in a single combined operation by a machine digging the trench by means of high-pressure water jets. The trench may be made up to 5ft deep, depending on the constitution of the sea bottom. This may be investigated by a new instrument, termed an " electro-geologograph," enabling rocky zones of the sea bottom to be avoided in cable laying.—" A Method of Burying Submarine Cables Evolved for the Protection Against External Damage of the Longest Japanese Submarine Cable," T. Ohba and I. Tanaka, *R.G.E.,* Vol. 65, No. 10, pp. 551-560, October, 1956, in French.

Rectifier Current-Voltage Relations

The Graetz bridge circuit has lately become increasingly important in rectifier design. It is therefore rather surprising that no thorough theoretical analysis of its current-voltage relations has been attempted, the more so as, despite the apparent simplicity of the circuit, some of the inherent difficulties besetting the analysis of other rectifier circuits are paralleled here (magnetic couplings, steep-fronted ignitions, current-voltage characteristic representing an elliptic arc). The analysis presented is based on the possible representation of the actual three-phase bridge circuit by a series connection of two three-phase half-wave circuits.

The whole load range from no-load to short circuit may be divided into three sub-ranges. In the first of these, two or three valves conduct alternately. The current-voltage characteristic is the straight line known from the three-phase half-wave circuit. From a certain load, the commutation intervals of one of the half-wave three-phase circuits retard the ignition of the valves of the other three-phase circuit; the rise of the valve currents in one circuit

therefore always coincides with the extinction of the currents in the other circuit, as a distinct rush. In this second sub-range, three valves are always conducting, and the current-voltage characteristic is an elliptic arc. With a further load increase the commutation intervals of the two half-wave three-phase systems begin to overlap, and in this sub-range three or four valves are alternately conducting; the characteristic becomes again linear, and the range terminates at the point of the ideal short circuit, where always four valves are conducting.

In the conventional half-wave circuits without magnetic couplings between the phases the valve currents circulate at the short-circuit point through 360 deg, and in the Graetz bridge through 240 deg. The author calculates current-voltage characteristics, mean and effective valve currents, phase and mains currents, transformer VA and mains power factor for Y/Y, Y/Δ, Δ/Y and Δ/Δ connection.—" Relations Between Current and Voltage of a Rectifier in Graetz Bridge Connection," W. Dallenbach, *Elettrotecnica,* Vol. 45, No. 3, pp. 133-142, 10th to 25th March, 1957, in Italian.

Surge Protection

A statement of the fundamental principles and requirements to be satisfied by the surge protection of rotating machines introduces a theoretical analysis of the methods available for this purpose. Two sets of surge divertors combined with a capacitor bank and supplemented by the surge impedance of the lead-in cable (or by an inductance) are a possible solution of the problem. The analysis also considers the effect of a series resistance and of the characteristic impedance of the protected winding. The main interest centres on the protection of machines supplied through transformers.

In this case the electrostatic component has a considerable influence which must be considered before a decision whether a special protective arrangement is suitable or even required, can be made. This case is illustrated by a worked numerical example. The protection of machines connected to overhead lines is only briefly touched upon, because it has formed the subject of many previous publications. The remaining sections deal with the protection of d.c. machines, protection against switching surges, and the design of special surge divertors for rotating machinery.—" The Surge Protection of Rotating Machines," V. Lesny, *Elektrotech. Obzor,* Vol. 46, No. 3, pp. 120-125, March, 1957, in Czech.

Generator Transformers

Although the theoretical foundations and practical design principles of generator and system transformers are identical there are many special requirements to be considered in the case of the former, especially if they are to be used in unit connection with the generators. Nowadays these transformers are too large to permit them to be fitted with tap-changers; separate regulating transformers have to be used, in themselves very heavy pieces of equipment and, as an example given shows, for large throughputs preferably further subdivided into a regulating auto-transformer and an auxiliary transformer.

As regards the generator transformer itself, which is frequently built as a travelling transformer, its design will differ according to whether it is of the two- or three-winding type, and in the latter case whether it needs two l.v. or two h.v. windings. Obviously, two l.v. windings will be required if the transformer absorbs the output of two generators, two h.v. windings if it has to supply two transmission systems. Special problems have to be solved to render generator transformers safe against short circuits and earth faults in the system as well as in connection with surge protection. The solution of these problems depends on the method of earthing adopted in the system(s) supplied. The authors' considerations are illustrated by types of generator transformers developed by Siemens-Schuckertwerke since the war.—" Generator Transformers," J. Drabeck and A. Wienhard, *E.T.Z.(A),* Vol. 78, No. 3, pp. 92-98, 1st February, 1957, in German.

Load Angle Measurement

A new method of measuring the load angle of a synchronous machine during transient periods is presented. A small auxiliary alternator whose rotor is fixed to the synchronous machine under investigation forms one part of the experimental set-up, the other part of which is a differential selsyn the stator winding of which is connected to the mains and also to the synchronous machine. The selsyn rotor is supplied by the auxiliary alternator. Owing to these circuit connections, the selsyn is stationary when the synchronous machine runs steadily, but starts rotating when the machine under investigation is in a transient state. A rotary potentiometer on the selsyn shaft enables a voltage proportional to the load angle to be tapped off and recorded. A certain distortion of the voltage record is caused by the inertia forces of the selsyn rotor; however, owing to the comparatively slow rate of the torque fluctuations of large synchronous machines, the inertia effects of the small selsyn rotor introduce only insignificant errors into the determination of the load angle variations.—" Measurement of the Load Angle of a Synchronous Machine in the Transient State," J. Burda, *Elektrotech. Obzor,* Vol. 46, No. 3, pp. 137-140, March, 1957, in Czech.

Detector Type Relay

In contradistinction to impedance relays without non-linear elements, the detector-type relay may give different expressions for the torque for the same characteristic in the complex plane. The paper compares the various possible expressions of the torque and finds from these the optimum solution on which the relay design is based. The general expression of the torque is

$$M = k\left[a\left|\dot{U} - b\dot{I}\right| - b\left|\dot{U} - a\dot{I}\right|\right] - M_{res},$$

where M_{res} is the constant resetting torque.

To increase the steepness of the rise of the torque at the end of the zone of the pole, a and b must be as close as possible to the end of the zone, at different sides of it, and on the junction of the end of the zone with the origin of the co-ordinates. On the other hand, to assure a sufficiently large torque, the points a and b have to be removed from the end of the zone so that, with a given steepness (which does not change much in the process), the torque can rise to the required value from the end of the zone to point a.

The detector-type impedance relay with a circuit based on the optimum positions of a and b has better characteristics than relays of the conventional design. With the same rate of rise of the torque at the end of the zone the power consumption will be less than half the consumption of the conventional type or, with the same consumption, the rate of rise of the torque at the end of the zone may be increased by more than 40 per cent. The temperature rise of the relay is so much reduced that torque increase is no longer restricted by thermal stresses.—" Optimum Circuit for a Detector-Type Directional Impedance Relay," V. L. Fabrikant, *Elektrichestvo,* No. 7, pp. 36-41, 1956, in Russian.

Sound and Light

THE STORY OF WOBURN ABBEY

ALTHOUGH the idea was first developed across the Channel, we are not sure (to echo Sterne) that "*Son et Lumière*" is one of the matters which they order better in France since seeing the application of sound and light to Woburn Abbey, the Duke of Bedford's home. We were entertained at a "preview" on 1st August of the excellent arrangements which have been made to illuminate the east front of the 18th century main building and its surroundings and to tell "The Story of Woburn."

Naturally from our point of view the main interest lies in the lighting installation which is cleverly used to emphasise points in the narration and to suit the mood in the different passages. In addition the display is enhanced by "effect" lighting devices, e.g. the passing of an aeroplane shadow over the front of the building, an illuminated fountain and coloured lighting in the windows of the house.

The fluorescent colour change and tungsten lighting equipment was supplied by the Atlas Lighting Division of Thorn Electrical Industries, Ltd. Altogether some 300 light sources are used, the installation with all lamps "full up" floodlighting a panorama over 200 yards in extent. During the performance, lasting about an hour, there are nearly 150 "lighting cues." The lighting sequences and their co-ordination with the script were worked out by Mr. Norman Allen and "Atlas" lighting engineers in close collaboration.

The basic aim of the installation is to provide maximum flexibility, giving variation of illumination level, direction and colour. Tungsten lighting is used to give strongly directional effects, but all colour changes are achieved by mixing the correct proportions of coloured fluorescent light. This is claimed to be the first time that electronically controlled fluorescent dimming has been used for an entertainment of this kind. Previous "Sound and Light" spectacles staged in France have used only incandescent lamps, which provide variation in direction and intensity but are limited for colour-change effects.

The Atlas Lighting Division has had considerable experience in the development of dimming circuits for fluorescent tubes and the method has already been used by the Atlas Theatre Lighting Department for landscape lighting and the floodlighting of buildings.

The chief advantage of fluorescent illumination is that colour effects are obtained by an "additive" process instead of the "subtractive" effect of filters used with incandescent lamps. With fluorescent tubes there are considerable economies in electrical loading and current consumption and the total load of the Woburn installation does not greatly exceed 50 kW. As the audience is relatively close to the building, light sources that can be used at close range are necessary and fluorescent tubes meet this requirement well.

All the circuits, both fluorescent and tungsten, are electronically controlled, and despite the complexity of the lighting sequences the entire installation is regulated by only two operators working together, in charge of five 12-way control boards at a single panel. The three colour circuits use 5ft 80 W tubes in blue, red and gold.

The vital controlling factor in this type of lighting is the thyratron valve, two valves connected in reverse parallel being able to control up to eight 80 W tubes or

Messrs. Robert Atkins, Norman Allen, Brian Brooks and C. R. Passmore (chief engineer, Atlas Theatre Lighting Department) in the lighting control hut at Woburn Abbey

The title picture shows the illuminated east front

an incandescent lamp load of 1,500 W. All the lighting equipment is completely weatherproof, the only protection necessary for the fluorescent tubes being the rubber sleeves on the end caps. The tubes and fittings used will function quite normally if completely immersed in water.

For certain special effects, it was found that a fluorescent light source of higher than normal intensity was desirable, and a few very-high-output tubes were used. This is the first commercial application of these tubes, which were announced by Atlas as a development project at this year's Electrical Engineers' Exhibition.

The actual "Story of Woburn" (by Miss Gladys Scott-Thomson) has been recorded by a number of narrators, including the Duke and Duchess and their family, and produced by Mr. Robert Atkins. Appropriate music accompanies the story.

Reproduction is by an installation of line source speakers installed by Pamphonic Reproducers, Ltd. The line source system reinforces natural sound, as opposed to unnecessary amplification. It is claimed that a person sitting near the source hears exactly the same volume of sound as one sitting at the back of the auditorium. This type of sound is new and is called Pamphonic Line Source. The system has recently been installed by the B.B.C. in its studios and it is the basis of the public address system at the new UNESCO buildings in Paris.

The line source system is driven by standard Pamphonic amplifiers of the type which can be used for any theatrical and industrial application, outdoor or indoor. At Woburn Abbey the full power is not being used. Line source speakers can be manipulated to eliminate all echo and are able to throw sound to up to one mile.

The proceeds from admission charges to the public are to go to the Bedfordshire New Churches Appeal Committee, on whose behalf Lord Luke of Pavenham spoke at the preview, thanking for their assistance Thorn Electrical Industries, Ltd., Pamphonic Reproducers, the Igranic Electric Co. and W. H. Allen, Sons & Co. Mr. S. H. Pryor, of Igranic, is the publicity manager for the spectacle.

RADIO RESEARCH

THE report of the Radio Research Board of the Department of Scientific and Industrial Research for the year 1956 (H.M. Stationery Office, price 3s) says that the greater part of the Board's work is now carried out at the Radio Research Station, Slough, where the new building together with the facilities now available enabled the transfer of the former Radio Division of the National Physical Laboratory, Teddington, to be completed during the year. In addition to the work at Slough, ionospheric observatories are maintained at Inverness, Singapore and Port Stanley and some investigations are undertaken for the Board in the universities.

The report states that the main emphasis of the research programme has been on radio wave propagation and closely related subjects. In this field the study of transmission by way of the ionosphere over a wide band of frequencies has claimed much attention, but increasing effort is being applied to the use of much higher frequencies where the transmission characteristics are determined by the surface of the earth and the lower atmosphere rather than conditions in the ionosphere. The object of this work is to obtain the detailed knowledge which is necessary to ensure the efficient and continually expanding use of radio waves for communication and other purposes.

With reference to the International Geophysical Year (1957-58), the Radio Research Station has already provided and dispatched equipment for use in the Antarctic at the Royal Society Base at Halley Bay, Coats Land, and training was given to those who will operate it. Staff of the Falkland Islands Dependencies Survey, who will operate similar equipment at Port Lockroy, Graham Land, were also trained during the year. Preparations are now in hand to extend the equipment and facilities at the Singapore Observatory to carry out detailed measurements of ionospheric drifts and the nature and intensity of atmospheric noise.

Experiments are in hand, in co-operation with the Admiralty, to investigate the possibilities of using radio waves in the region of 10-20 kc/s for long-distance navigational aids. Systems depending for their functioning on a measurement of the phase-difference between signals received from two or more widely separated phase-locked transmitters are in mind. The particular problem being studied is the influence of the ionosphere in introducing at a given observing point variations in what ideally would be a constant phase difference. For convenience, use is made of signals from existing very-low-frequency communication transmitters. A particular transmitter is chosen and the stability is examined of the phase difference between the signals received from it at different places: thus the experimental method uses a disposition of transmitters and receivers which is the inverse of the case of a practical navigational aid. The two observing points are connected together by a Post Office land-line in such a way that direct comparison may be made between the phase fluctuations of the two received signals. Development of the equipment has been completed and observations are now in hand.

Semi-Conductors and Transistors

The portion of the programme in the field of semiconductors and transistors is directed towards obtaining a better understanding of the physical processes occurring in semi-conductors and in related devices such as transistors which are rapidly being developed for various radio and electronic purposes. The research work in progress is concerned with the study of the noise which is generated in monocrystalline filaments of semi-conductors when carrying current and in back-biased diodes; measurements have also been made on the characteristics of transistors with a view to interpreting the various parameters connected with their operation, and some attention is given to the circuit arrangements used in various applications of transistors. In the past, germanium filaments have received most attention, but with the increasing importance of silicon and its use in the development of transistors, experience is also being obtained with that material. The research work on transistors is mainly devoted to measurements which will assist in applications at high radio frequencies.

The work mentioned in last year's report which is carried out for the organisation in the universities continues, and its nature remains unchanged except that the measurement of the properties of ferrites has been discontinued in the Electrical Engineering Department of Imperial College and transferred to the Radio Research Station, Slough.

United States Electrical Trade

Exports and Imports in 1955 and 1956

EXPANSION of electrical trade stands out as one of the important factors underlying the buoyancy of the United States economy last year. Exports (excluding military aid) climbed to £347 million, representing a 15 per cent increase on the figure of £302 million for 1955. The following tables give the principal American trade figures grouped by products and countries. The statistics of Tables 2 and 4 are based on all shipments individually valued at $500 and over for exports and $250 and over for imports, representing about 95 per cent of the total trade (£1=$2·8).

Mainly because of the declining importance of Argentina as a market, the relative expansion of United States sales to Latin America as a whole was somewhat less remarkable than the corresponding increase in shipments to Canada and the growth in certain individual Latin American export markets, particularly Venezuela, Cuba and Mexico (Table 1). The share of the United States in Canadian electrical imports amounted to nearly 86 per cent. The emergence of new markets in the Middle East, where United States interests have made prominent contributions to the development of the oil industry, has been a noteworthy feature during the past year. As regards trade as a whole, exports to countries like Saudi Arabia, Kuwait and Iran have displayed an almost steady upward trend in recent years. American exports to Asia have relatively risen much faster than imports from these countries, while exports to Canada, Latin America and Europe have increased in the same proportions as American imports from these markets.

Whereas Japan before the war financed her dollar imports by maintaining an export surplus with America, in post-war

Table 1.—American Electrical Exports, 1955-56 Principal Markets ($000)

Countries	1956	1955
United Kingdom	9,302	9,437
Canada	264,140	234,647
Mexico	47,957	36,679
Guatemala	4,576	2,904
Costa Rica	3,579	2,602
Panama	3,550	2,149
Cuba	35,348	30,511
Jamaica	2,346	604
Dominican Republic	5,053	4,464
Colombia	29,077	25,845
Venezuela	51,008	38,383
Ecuador	2,906	2,457
Peru	12,631	8,426
Chile	6,678	3,317
Brazil	17,751	16,720
Uruguay	1,738	3,197
Argentina	8,530	5,289
Sweden	5,864	5,249
Holland	5,825	5,160
Belgium/Luxembourg	9,855	8,607
France	12,316	12,006
West Germany	6,396	3,750
Switzerland	6,136	4,646
Spain	7,997	3,131
Portugal	1,748	2,147
Italy	14,303	10,822
Greece	2,377	2,358
Turkey	6,223	6,392
Lebanon	3,053	3,096
Iraq	2,149	2,237
Iran	5,256	4,313
Israel	3,027	7,936
Saudi Arabia	6,144	4,434
India	6,391	6,147
Pakistan	5,134	1,764
Thailand	4,817	4,542
Indonesia	6,829	3,268
Philippines	20,120	20,214
Korea	6,513	5,058
Taiwan	7,634	12,136
Japan	15,920	9,984
Australia	7,719	4,937
Morocco	1,795	2,105
Egypt	2,457	2,531
Belgian Congo	2,992	3,747
South Africa	9,918	10,213

Table 2.—American Electrical Exports, 1955-56 Principal Products ($000)

Product	1956	1955
Generators, d.c.	1,738	1,510
To Canada	1,041	1,045
Generators, a.c.	3,404	3,608
To Canada	857	602
,, Mexico	131	272
,, Colombia	486	230
,, West Germany	220	123
Generator sets, steam turbine, under 500 kW	512	363
To Canada	39	60
,, Israel	174	—
Ditto, 500 to 7,500 kW	3,978	2,386
To Mexico	804	662
,, Cuba	501	580
To Iran	573	150
,, Jamaica	512	—
Ditto, over 7,500 kW	12,872	6,216
To Venezuela	2,338	—
,, Korea	2,350	—
,, Japan	7,272	—
Arc welders, d.c. type	8,223	5,994
To Canada	1,421	851
,, Mexico	719	644
,, Venezuela	851	505
Diesel generator sets	28,952	16,846
To Mexico	4,014	1,591
,, Costa Rica	1,390	55
,, Cuba	1,122	956
,, Venezuela	1,879	872
,, Peru	1,669	203
,, Brazil	1,034	1,015
,, Indonesia	1,294	259
,, Philippines	1,089	545
Storage batteries, lead-acid type	5,205	5,516
To Cuba	565	508
,, Colombia	223	413
,, Venezuela	820	1,154
Ditto, n.e.c. cell	2,223	1,660
Batteries, flashlight, cell	4,974	6,043
To Venezuela	916	812
,, Thailand	1,132	1,361
Ditto, dry, multiple cell	4,053	4,209
To Canada	366	537
,, Cuba	635	863
,, Colombia	414	394
Capacitors	849	912
To Canada	176	133
,, Brazil	45	433
Power transformers not over 500 kVA	6,611	5,297
To Canada	328	469
,, Cuba	768	686
,, Colombia	759	486
,, Venezuela	1,440	1,157
,, Philippines	583	323
Ditto, above 500 kVA	5,189	6,213
To Mexico	567	101
,, Venezuela	1,113	534
,, Brazil	1,250	1,429
Instrument transformers	3,429	3,387
To Canada	166	233
,, Colombia	2,001	1,893
Fluorescent ballasts	3,499	3,215
To Canada	1,003	855
,, Colombia	504	596
Regulators	4,209	1,425
To Canada	792	536
,, Colombia	2,289	55
Rotating convertors under 150 kW	2,907	1,857
To Canada	536	650
,, Turkey	559	24
Ditto, 150 kW and above	1,754	879
To Canada	237	239
,, Holland	552	34
,, Spain	578	131
Rectifiers, non-rotating, including battery chargers	3,917	3,413
To Canada	1,988	1,791
Switchboards and panels, primary, and parts	16,289	13,778
To Canada	1,116	548
,, Colombia	1,650	1,070
,, Venezuela	2,564	1,636
,, Brazil	1,809	1,257
,, Spain	1,533	249
,, Philippines	893	1,007
,, Japan	789	2,561
Switches, power circuit-breakers, and parts	23,497	16,207
To Canada	8,772	5,032
,, Mexico	1,019	861
,, Cuba	846	640
,, Colombia	856	722
,, Venezuela	1,136	917
,, Brazil	692	481
,, Philippines	645	515
,, South Africa	583	608
Indicating instruments, non-recording, n.e.s.	3,046	2,622
To United Kingdom	49	62
,, Canada	945	909
Recording instruments, n.e.s.	1,148	992
To Canada	395	394
Testing instruments, n.e.s.	16,272	13,877
To United Kingdom	712	563
,, Canada	3,829	3,745
,, Sweden	584	612
,, France	1,344	1,677
,, West Germany	531	176
,, Italy	823	900
,, Japan	660	356
,, Australia	627	283
Motors, ¼ h.p. and under	4,526	3,782
To United Kingdom	186	160
,, Canada	1,744	1,271
Ditto, over ¼ h.p. and under 1 h.p.	2,133	1,661
To Canada	601	547
,, Mexico	225	190
Ditto, 1 h.p. up and including 200 h.p.	12,345	8,197
To Canada	2,952	1,587
,, Mexico	1,421	941
,, Cuba	644	368
,, Venezuela	613	467
,, Philippines	545	392
Ditto, above 200 h.p.	4,500	2,334
To Canada	477	328
,, Mexico	697	266
,, Spain	705	153
Industrial motor controls, n.e.s.	12,587	7,483
To United Kingdom	198	208
,, Canada	3,885	2,058
,, Mexico	1,031	579
,, Belgium	889	690
Motor parts, n.e.s.	7,072	5,651
To Canada	3,332	2,519
Portable tools for metal working	6,130	5,134
To Canada	2,860	2,542
Household refrigerators	51,115	49,073
To Canada	13,772	13,986
,, Cuba	4,800	4,108
,, Venezuela	5,305	5,110
,, Peru	1,499	1,592
,, Belgium	1,304	1,148
,, Lebanon	1,844	1,866
,, Iran	1,896	1,511
,, South Africa	1,118	1,549
Farm and home freezers	10,344	11,569
To Canada	7,993	8,866
,, Sweden	358	759
Household refrigerator and freezer parts, n.e.s.	14,771	14,006
To Canada	8,019	7,703
,, Mexico	1,206	801
,, France	878	519
,, South Africa	581	724

(Continued on page 254)

years she has financed a large portion of her increased dollar imports by means of United States Government aid and receipts from American military expenditure. The same applies to Korea, Formosa, Indochina, and to a certain extent to Italy. Exports to India and Pakistan, also consisting in part of products shipped under United States Government programmes, have risen relatively much faster than United States imports from these countries. South Africa has developed into a prominent American export market, without the need for United States Government aid.

Exports of electronic equipment and domestic appliances were among products to show the largest gains during the period under review (Table 2). During last year exports to countries of the Western Hemisphere represented about 86 per cent of the United States total radio and TV exports and 75 per cent of the exports of domestic appliances. Canada took 46 per cent of the total United States exports of these products.

Among the principal supplying countries (see Tables 3 and 4), the United Kingdom ranks first with £9·3 million, representing 39 per cent of all United States electrical imports during last year. The corresponding figure for 1955 was £5·2 million. This remarkable achievement by British manufacturers was made in spite of severe Continental competition and the "Buy American Act." Among the specified classes transformers and generators formed an important part of the United Kingdom's exports to the United States.

Product	1956	1955
(Continued from page 253)		
Fans	4,103	3,779
To Canada	645	373
,, Mexico	509	733
,, Venezuela	471	312
Bulbs, large filament and other large base lamps	4,117	4,110
To Canada	1,278	1,120
,, France	129	163
Bulbs and tubes, lamps, fluorescent	4,278	4,737
To Canada	755	1,047
,, Switzerland	502	292
Household washing machines, non-automatic	3,189	3,255
To Canada	554	713
,, Venezuela	1,032	855
Ditto, semi or fully automatic	8,312	6,558
To Canada	3,365	2,628
,, Venezuela	1,114	952
Washing machine parts	5,491	4,001
To Canada	2,766	2,191
,, Mexico	1,078	723
Vacuum cleaners	3,273	2,582
To Canada	2,842	2,146
Mixers, juicers and blenders	3,682	2,876
To Canada	1,315	1,116
Dishwashers	1,382	907
To Canada	792	491
Appliances and parts, household motor driven, n.e.s.	7,515	7,204
To United Kingdom	225	501
,, Canada	2,920	3,081
,, Mexico	418	297
,, Switzerland	484	464
,, Italy	260	311
Flat irons	1,025	980
To Canada	99	116
,, Cuba	169	125
,, Venezuela	245	237
Cookers, above 2½ kW	3,338	4,128
To Canada	1,490	2,574
,, Cuba	457	251
Cooker parts, n.e.s.	5,126	4,019
To Canada	3,507	2,821
Industrial furnaces, melting and refining plant	778	367
To Mexico	305	2
,, Venezuela	214	3
Industrial furnaces, heat treatment	1,011	1,706
To United Kingdom	146	37
,, Canada	351	294
Parts of industrial furnaces for melting, refining and heat treatment	1,525	3,441
To United Kingdom	122	51
,, Canada	514	1,860
X-ray tubes and valves, medical and dental	1,326	1,357
To Canada	277	339
X-ray tubes and valves, industrial	114	172
To United Kingdom	28	13
X-ray apparatus and parts, n.e.s.	7,331	6,393
To Canada	2,018	1,937
,, Colombia	490	297
,, Venezuela	443	270
Radio and TV transmitting equipment	8,081	8,695
To United Kingdom	242	255
,, Canada	1,278	2,091
,, Cuba	760	1,689
,, Japan	588	177
Car radio sets	2,661	2,586
To Canada	837	544
Radio receivers, n.e.s., excluding TV	3,015	4,078
To Canada	402	367
,, Cuba	535	483
TV receivers	18,989	10,052
To Canada	683	354
,, Cuba	5,206	3,944
,, Colombia	2,232	816
,, Venezuela	3,944	2,534
,, Italy	828	567
Electronic receiving tubes	17,489	16,948
To Canada	5,872	9,335
,, Mexico	2,097	1,362
,, Brazil	1,350	684
,, Argentina	1,566	73
TV camera tubes	1,297	1,150
To Canada	268	202
TV picture receiving tubes	13,165	15,390
To Canada	3,171	9,799
,, Mexico	986	617
,, France	1,711	2,109
,, Italy	3,917	827
,, Australia	849	11
Electronic tubes, n.e.s.	14,822	11,808
Crystal diodes and transistors	1,171	473
To United Kingdom	157	25
Electronic capacitors	5,467	4,688
To Canada	1,259	1,734
Electronic resistors	2,837	2,514
To Canada	481	839
Electronic inductors, including transformers	4,197	4,510
To Canada	1,121	2,086
Radio and TV loudspeakers	2,031	1,876
To Canada	361	370
Components for electronic apparatus n.e.s.	20,695	21,666
To Canada	7,734	13,520
,, Mexico	2,045	1,137
Accessories for electronic equipment and parts n.e.s.	8,377	7,440
To Canada	3,213	3,958
Telegraph apparatus and parts	13,714	8,575
To United Kingdom	507	839
,, Canada	6,300	2,220
,, Cuba	1,382	908
,, Australia	748	460
Telephone instruments	1,312	996
To Canada	316	120
,, Philippines	280	231
Telephone equipment and parts n.e.s.	30,062	22,330
To United Kingdom	2,966	2,954
,, Canada	11,517	9,730
,, Turkey	1,408	524
,, Pakistan	1,583	48
,, Philippines	1,720	919
,, Korea	1,474	163
,, Taiwan	1,278	1,778
Public address systems	3,649	3,273
To Canada	360	327
,, Mexico	383	402
Starting, lighting and ignition apparatus and parts	30,682	26,760
To Canada	8,599	8,292
,, Mexico	1,543	1,604
,, Venezuela	1,353	1,071
,, Indonesia	1,025	337
Iron or steel conduit	4,259	3,645
To Canada	983	703
,, Venezuela	651	466
Conduit fittings, outlets and switch-boxes, metal	7,163	5,562
To Canada	2,089	1,911
,, Colombia	591	304
Pole line transmission and distribution hardware	9,265	8,426
To Canada	2,265	1,825
Interior wiring devices and parts	10,732	10,256
To United Kingdom	106	98
,, Canada	3,372	3,722
,, Colombia	523	571
Insulated wires and cables for buildings	4,682	5,809
To Canada	456	346
,, Cuba	481	529
,, Philippines	965	683
Wire and cable, communication and signal	5,246	8,751
To Canada	646	586
Cord, wire and cable portable, rubber or synthetic rubber sheathed	2,535	1,326
To Canada	1,145	422
Wire and cable, rubber covered, excluding building, plain, braided, etc.	7,203	5,575
To Canada	732	492
,, Venezuela	1,815	1,058
Wire and cable, varnished-cambric insulated, braided, etc.	1,586	994
To United Kingdom	80	106
Cable, power, paper insulated with lead or armour covering	609	193
Steam turbines	5,554	7,914
To Canada	2,069	523
,, Japan	1,674	4,149
Turbines, n.e.s.	5,197	1,193
To Venezuela	3,316	444
Steam engine, turbine and water wheel parts	7,620	8,829
To Canada	1,347	960
,, Japan	1,431	2,456

Table 3.—American Electrical Imports, 1955-56 Principal Supplying Countries (000 $)

Supplier	1956	1955
United Kingdom	26,131	14,714
Canada	15,468	9,560
Sweden	2,382	1,551
Holland	6,732	5,140
Belgium/Luxembourg	2,154	802
France	3,067	2,465
West Germany	23,743	12,760
Switzerland	4,352	2,336
Italy	2,295	966
Hong Kong	1,634	1,105
Japan	8,069	3,084

Table 4.—American Electrical Imports, 1955-56 Principal Products by Countries of Origin (Values in $)

Product	1956	1955
Lamps n.e.s. including neon and mercury	1,112,341	752,476
From United Kingdom	16,093	7,515
,, Holland	182,136	107,335
,, Japan	794,318	551,447
Household floor polishers	1,841	14,812
Vacuum cleaners	114,787	25,435
From United Kingdom	6,365	1,805
,, Japan	107,976	13,369
Generators and parts n.e.s.	4,656,363	393,152
From United Kingdom	3,035,962	76,974
,, Canada	735,007	252,514
,, Belgium	241,500	—
,, West Germany	132,953	42,076
,, Switzerland	484,985	5,138
Transformers and parts	3,751,193	3,414,205
From United Kingdom	2,133,865	1,906,225
,, West Germany	365,730	42,749
,, Austria	52,366	750,316
,, Switzerland	609,422	297,284
,, Italy	531,856	361,750
Articles n.e.s. for controlling and rectifying electrical energy	5,887,994	3,909,676
From United Kingdom	1,507,754	344,391
,, Canada	2,921,319	2,767,572
,, France	291,504	65,877
,, West Germany	287,531	199,678
,, Switzerland	362,233	202,481
,, Italy	192,269	72,799
,, Japan	103,470	27,682
Switches over 10 A, fuses over 30 A n.e.s.	1,125,986	755,697

(Continued on page 255)

Product	1956	1955
From United Kingdom ...	69,035	58,732
,, Canada	115,675	75,213
,, France	93,170	97,493
,, West Germany ...	170,133	97,996
,, Switzerland ...	576,025	392,047
Motors not over 1/10 h.p. ...	418,636	Not available
From United Kingdom ...	232,626	,,
,, Canada	74,640	,,
Ditto, 1/10 up to 200 h.p. ...	984,574	Not available
From United Kingdom ...	650,899	,,
,, Canada	188,203	,,
Ditto, 200 h.p. and over ...	695,759	Not available
From United Kingdom ...	26,586	,,
,, Canada	597,624	,,
Railway motors, stationary, n.e.s.	2,043,792	2,728,093
From United Kingdom ...	1,051,609	1,346,366
,, Canada	432,621	692,370
,, Belgium	266,569	376,600
,, West Germany ...	125,414	149,173
Radio apparatus and parts ...	8,491,510	3,350,896
From United Kingdom ...	1,013,716	392,486
From Canada	788,868	367,306
,, Holland	801,285	584,810
,, West Germany ...	3,124,335	1,631,716
,, Japan	2,482,434	232,035
Telephone apparatus and parts	4,532,758	Not available
From United Kingdom ...	193,022	,,
,, Canada	2,707,424	,,
,, Sweden	742,361	,,
,, Belgium	392,408	,,
,, West Germany ...	412,869	,,
X-ray apparatus and parts ...	1,265,038	943,234
From Sweden	288,540	192,774
,, Holland	341,650	306,003
,, West Germany ...	311,489	229,321
Flashlights and cases ...	1,494,526	1,173,701
From West Germany ...	216,392	209,874
,, Hong Kong ...	1,173,501	885,994
Furnaces, heating ovens and parts	717,616	460,403
From Canada	191,934	153,067
,, West Germany ...	268,711	118,443
Electrical goods and parts n.e.s.	2,029,070	561,502
From United Kingdom ...	137,052	74,966
From Canada	1,366,009	235,725
,, West Germany ...	227,644	79,646
Electrical machinery and parts n.e.s.	49,606,612	26,767,857
From United Kingdom ...	14,568,177	6,928,200
,, Canada	3,666,797	2,147,227
,, Sweden	1,035,960	532,258
,, Holland	4,753,866	3,465,747
,, Belgium	1,007,030	175,731
,, France	1,673,479	1,740,095
,, West Germany ...	17,251,722	9,155,352
,, Switzerland ...	1,591,725	1,019,499
,, Italy	1,474,470	447,527
,, Japan	1,686,801	541,731
Steam turbines	259,118	1,203,015
From United Kingdom ...	—	1,203,015
,, Switzerland ...	208,525	—
Parts of steam turbines ...	310,031	98,450
From United Kingdom ...	5,932	23,173
,, Switzerland ...	268,257	66,848
Water turbines	63,360	17,305
From United Kingdom ...	12,520	2,533
,, West Germany ...	37,292	7,648

Radio Astronomy at Cambridge

NEW MULLARD OBSERVATORY

ON 25th July Sir Edward Appleton opened the Mullard Radio Astronomy Observatory of the University of Cambridge. This observatory has been provided, through the generosity of Mullard, Ltd., and with the help of the Department of Scientific and Industrial Research, to provide facilities for an extension of the work which Mr. M. Ryle has been carrying out in the Cavendish Laboratory at Cambridge since the war. This work has been concerned with the investigation of the radio waves reaching the earth from outer space, a subject which is now given the name of radio astronomy.

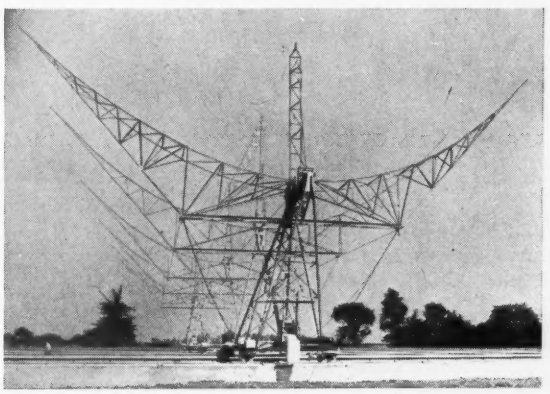
To obtain the greatest amount of information from the radio waves from outer space two requirements must be satisfied. First, the radiations must be received with the greatest possible strength; that requires the largest possible aerial for their reception. Second, the aerial must be of a kind which will provide an accurate measure of the angle of arrival of the waves. The power to make this measurement is called the " resolving power " and a great resolving power requires a large aerial.

Although the construction of the largest possible aerials would seem to be the best way of getting the strongest reception and the greatest resolving power, for some purposes they have insufficient resolving power. For many investigations the interferometer type of aerial is to be preferred. The " resolving power " of an aerial depends on the interaction or " interference " of the radio waves received at its edges, and the farther apart these edges are, the greater is the resolving power. Suppose, therefore, that an aerial is made as large as possible, so that because of its large *area* it collects a large power and because of the large *distance* between its edges it has great resolving power. Now suppose it to be split into two halves which are then moved apart some considerable distance. Then the total area of the aerial is unaltered so that the total power received is the same as before; but if the waves received in the two halves are properly combined they will, by their " interference " effect, provide a resolving power which is increased proportionally to the distance between them. In this way it is possible to increase the resolving power far beyond what is practicable with a single large aerial, and at the same time to keep the collecting power the same.

The Cambridge workers consider that their observations point to the conclusion that at very great distances the " radio stars " are closer together. If their conclusion is correct it would seem to favour a theory in which the Universe is supposed to be expanding from an initial highly condensed state, and to conflict with one in which there was supposed to be continuous creation of matter. Workers in Australia have criticised these results, and have stated that, with a different type of radio telescope, they have not been able to repeat the Cambridge observations.

Plans were made in Cambridge to extend the observations by constructing an " interferometer " in which both the collecting power and the resolving power would be increased. This was too large to be put on the same site as the existing interferometer and it was necessary to plan in terms of a new radio astronomy observatory. The site for the new Mullard Radio Astronomy Observatory is at Lord's Bridge, about 5 miles from Cambridge, and the new interferometer is now nearing the final stages of construction. A small observatory building contains the associated complex electronic equipment which makes the records. The equipment is run and the records are analysed by a small team of about 15 research workers, under Mr. Ryle, who has inspired all this work. These workers have to be fully familiar with the latest techniques in the use of aerials and electronic devices of considerable complexity, and it is hoped that the observatory will prove to be not only a place where astronomical results of the greatest importance will be obtained, but also a training ground for experts in modern radio techniques.

The moving aerial and railway tracks of the radio star interferometer during construction. The steelwork is complete and part of the dipole assembly in place. Length of the railway tracks is 1,000ft and the length of the aerial (i.e. the width across the railway track) 190ft. The distance across a parabola is 65ft



NEW ELECTRICAL EQUIPMENT

Welding Extra Thick Plate

The new "Fortrex 35A" electrode which gives all the required properties in welded joints in extra thick plates is now available from MUREX WELDING PROCESSES, LTD., Waltham Cross, Herts. The company also claims that the weld metal has particularly good impact properties at sub-zero temperature. It is an all-position electrode, simple to use, slag removal is easy and the radiographic quality of the weld metal is sound.

Plate up to 1½in thickness can be successfully welded by using the normal low hydrogen electrodes of the "Fortrex 35" type and satisfactory tensile, elongation and impact properties can be obtained throughout the full thickness of the weld.

Fire Warning Siren

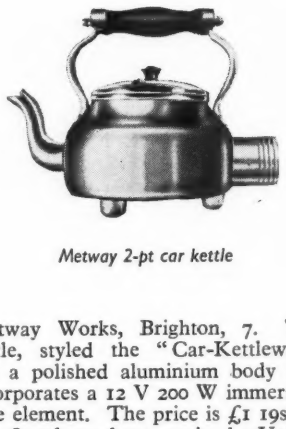
An improved version of the "Secomak" G.P.1 siren is now being made by the SERVICE ELECTRIC CO., LTD., Secomak Works, Honeypot Lane, Stanmore, Middlesex. This employs diecastings throughout and it is designed to be compact, having sound box, motor, and built-in terminal box all in line. This allows it to be mounted unobtrusively in a small space close to walls, ceilings, etc. It is suitable for outdoor as well as indoor use. An easily removable cover gives access to the terminal box, which is arranged for ¾in conduit or cable gland and also allows inspection of the commutator.

Motors are universal a.c./d.c. Standard voltages are 100/115 and 200/250, but these sirens can be supplied for any specified voltage, a.c. or d.c., from 6 V upwards. Approximate electricity consumption is 230 VA. Overall dimensions are 8in by 4in by 4in, weight 3 lb. The high peripheral speed of the sound rotor gives a powerful and penetrating note of nearly 1,000 c/s which is audible in still air at over half a mile and can be heard above considerable background noise.

Fire warning siren manufactured by Service Electric Co., Ltd.

Car Kettle

A 2-pint electric kettle specifically for use in cars has been introduced by METWAY ELECTRICAL INDUSTRIES, LTD., Metway Works, Brighton, 7. The kettle, styled the "Car-Kettleway," has a polished aluminium body and incorporates a 12 V 200 W immersion type element. The price is £1 19s 9d, plus 8s 7d purchase tax in the United Kingdom.



Metway 2-pt car kettle

"Breeze" spin dryer

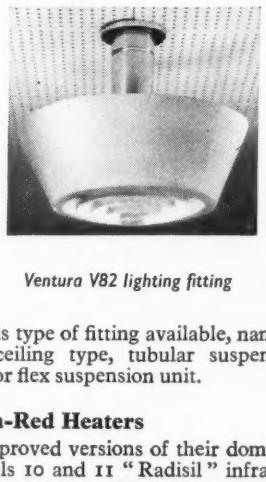
Spin Dryer

A new spin dryer, the "Breeze," has recently been placed on the market by C. H. MARTIN, LTD., Jubilee Road, Letchworth. Its direct drive is claimed to give silent, smooth running with no vibration and the extractor system enables small articles of clothing to be dried ready for ironing within 2 to 3 minutes. Sheets and large tablecloths can be dried in about 30 min but the machine is not suitable for blankets.

It is constructed of heavy gauge sheet steel finished in white stoved enamel, and the lid, of aluminium, is available in various colours. Rubber feet are fitted and the motor, with a power rating of less than 500 W, is rubber mounted and completely isolated from the machine. The container has a capacity of approximately 4 lb and the overall dimensions are 24in high by 12in in diameter. The price is £21 plus £9 9s purchase tax in the United Kingdom.

Lighting Fittings

A ceiling type Ventura lighting fitting is now available from THE MERCHANT ADVENTURERS OF LONDON, LTD., 16-43, Portland Road, London, W.11. This fitting, known as the Ventura V82, is a louvred diffuser moulded in translucent opal urea formaldehyde and can be obtained either in white, light peach or pale yellow. The unit provides a 90 deg cone of almost uninterrupted downward illumination through the bottom aperture which is louvred to prevent a view of the lamp from normal angles of vision. It is 12in in diameter and is designed for 100, 150 or 200 W lamps, the retail price including tax in the United Kingdom being £1 12s 8d. There are three versions of this type of fitting available, namely, the ceiling type, tubular suspension unit or flex suspension unit.



Ventura V82 lighting fitting

Infra-Red Heaters

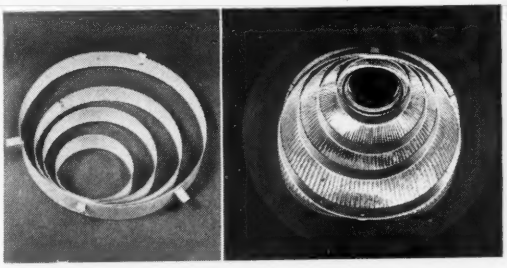
Improved versions of their domestic models 10 and 11 "Radisil" infra-red radiant heaters with increased output efficiencies have been introduced by HANOVIA (LAMPS DIVISION OF ENGELHARD INDUSTRIES, LTD.), Bath Road, Slough, Bucks. Known as models 30 and 31, respectively, they are similar in general design to the previous models, with, however, their spirally-wound nickel-chrome wire elements enclosed in silica sleeves of wider diameter and thickness to form a more robust, durable unit. Chromium-plated metal strips are also fitted along the top and bottom edges of the removable safety guard to afford a more decorative finish.

Model 30 has a weight of 4½ lb and measures 26in long by 3½in wide by 4¾in deep. There is a choice of

elements rated at 350, 525 or 725 W. Model 31 weighs 7 lb and has an overall length of 48in, slightly longer than model 11. It is fitted with a 1,500 W element. Both models can be supplied to operate on 200/220 or 230/250 V, and are now being provided against existing orders for models 10 and 11.

Display Lighting Fitting

It is claimed that with the "Rivlite" contemporary light correction filter and louvre the appearance and effectiveness of recessed shop window reflectors is greatly improved. The "Rivlite," a product of J. RIVLIN, LTD., 17, Brunswick Street, Leeds, 2, is a simple unit which may be clipped into position on the reflector. The concentric circles of the filter not only transform the appearance of the ordinary reflector but prevent dazzle without losing brilliance. Coloured lighting is also said to benefit as truer colour is obtained due to the correction of the reflections. It is available finished in white or in colours.



Rivlin "Rivlite" light correction filter and (on right) fitted in reflector

Lightweight Batteries

Two new batteries have recently been introduced by CHLORIDE BATTERIES, LTD., Exide Works, Swinton, Manchester. They are the 6-MNA17 and 4-MNB17 units, with a capacity of 4 Ah at 12 V and 8 V, respectively. In basic design the two batteries are very similar, but their applications differ. The 6-MNA17 12 V battery is primarily designed to operate portable and airborne v.h.f. equipment and other special electronic devices, while the 4-MNB17 8 V unit is intended for valve-operated electronic apparatus.

The design of these batteries includes many novel features with an important bearing on performance. The cells are assembled in tough containers of translucent high impact polystyrene. The battery covers are one-piece mouldings of the same material. Gas vents, incorporating traps for acid spray, are positioned in the covers and each cell has a separate filler plug.

Within each cell, positive and negative plates are separated by sheets of "Porvic," a microporous plastic material. The separators are wrapped around the positive plates, enclosing both sides and one edge of the plate. The 6-MNA17 battery also has sheets of resin-banded glass wool against the positive plates as protection from the effects of vibration frequently encountered in service. Terminals, located on top of the battery, are not directly connected to the end cell take-offs. Each consists of a monel metal insert moulded in the battery cover into which is screwed a small monel metal bolt with an insulated head. When this bolt is tightened, the cable end on the external lead is clamped firmly against a lead alloy strip which passes over the edge of the battery container and is connected to the end cell take-off.

This offset method of terminal connection has many advantages, including freedom from corrosion troubles in service and the capacity to withstand mechanical abuse such as severe tightening.

Exide 4-MNB17 8 V ultra-lightweight battery

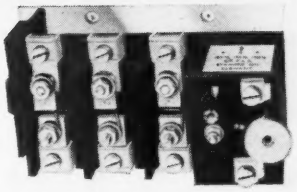
The manufacturers claim that at low temperatures these batteries will give high-rate discharges of the order of 100 A with high terminal voltages—a particularly impressive performance when their small size, low weight and unspillability are taken into account.

Motor Protection Thermostat

A miniature thermostat, the "Paratherm," with a great variety of applications in the electrical industry, especially for motor protection, is now being marketed by WALTER LOGAN & CO., LTD., 34, Oak Tree Drive, Totteridge, London, N.20. The operating part of the thermostat is a curved bi-metal disc to the centre of which is attached a heavily silver plated contact. In size it measures only $\frac{3}{4}$in in diameter and the thickness is $\frac{7}{32}$ in. The weight is approximately $\frac{1}{8}$ oz. It is manufactured with an opening contact, a closing contact or an open-close contact (combined) for fixed operating temperatures up to 392 deg F. The tolerances are ± 9 deg F up to 212 deg F and ± 5 per cent above this temperature. These tolerances suffice in most cases but units with tolerances of more constricted limits for special purposes may also be supplied.

Thermal Overload Relays

The UOL range of thermal overload relays manufactured by M.T.E. CONTROL GEAR, LTD., Leigh-on-Sea, Essex, incorporates single-phasing protection as well as protection for normal overload. The relays, which are built to comply with B.S. 587/1957, are C.S.A. approved and employ bi-metallic actuators operating on trip bars capable of differential movement. They are ambient temperature compensated, hand or auto-reset selector provided and indirectly heated, all heater elements being easily exchanged.



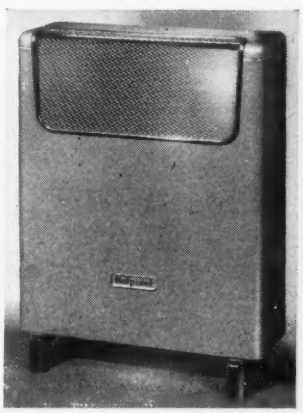
M.T.E. Control Gear thermal overload relays with single-phasing protection

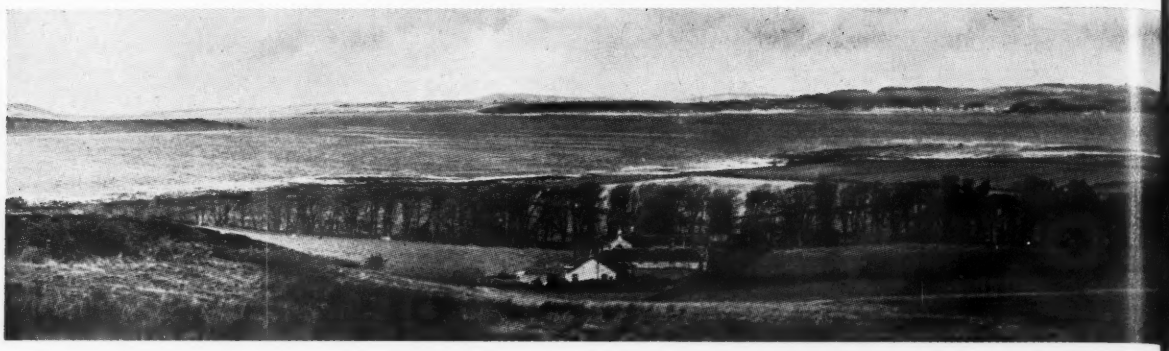
All the relays in this range can be fitted integrally with contactors or can be mounted as independent units for fitting to new or existing control gear. The range extends from $\frac{1}{4}$ A to 85 A on a.c. supplies up to 600 V. There are three trip setting points moulded in the top plate and they correspond to 100, 125 and 150 per cent full load, but any intermediate setting can be selected as required.

Convector Heater

Included among the range of electric space heating appliances announced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., is a neatly styled convector heater now available in a silver grey or bronze finish. It measures 24in high by 18in wide and the total weight is only 19¼ lb. A special air duct, similar to a chimney, ensures minimum heat loss through the body of the heater. It is provided with two 1 kW elements one of which is controlled by a switch. Reflected light from a 60 W amber coloured lamp in the base gives an impression of warmth. The price is £8 0s 6d plus £3 10s 6d purchase tax in the United Kingdom.

Hotpoint convector heater





A panoramic view, specially taken for the "Electrical Review," of the site of the nuclear power station to be erected by the G.E.C.—Simon-Carves Group at Hunterston, Ayrshire. We announced last week that the Secretary of State for Scotland had signified his approval of the use of the site subject to certain conditions

GENERATION AND DEVELOPMENT

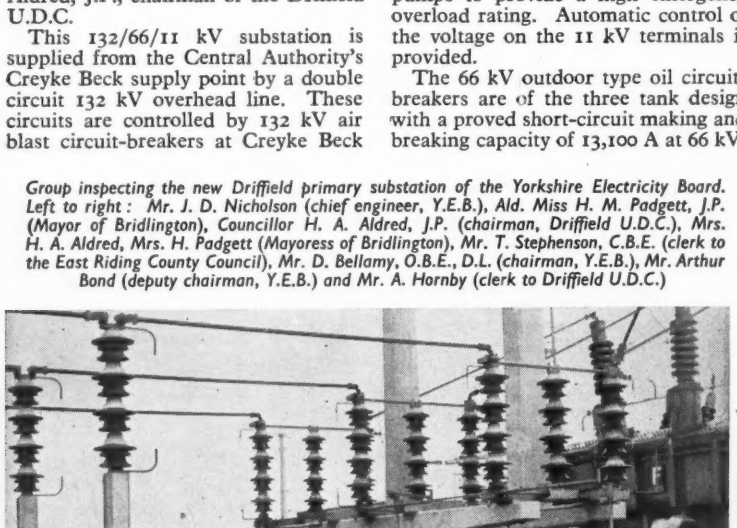
New Yorkshire Primary Substation

The Yorkshire Electricity Board's new primary substation at Driffield, which will furnish supplies to a large area of the East Riding, including Driffield itself, Bridlington, Pocklington, Hornsea and parts of Filey, Norton, Howden, Holderness and Beverley, was recently officially inaugurated by Councillor H. A. Aldred, J.P., chairman of the Driffield U.D.C.

This 132/66/11 kV substation is supplied from the Central Authority's Creyke Beck supply point by a double circuit 132 kV overhead line. These circuits are controlled by 132 kV air blast circuit-breakers at Creyke Beck and are connected at Driffield through air break isolators to two 60 MVA 132/66 kV transformers supplying the Board's 66 kV busbar. These transformers are of the outdoor, oil-cooled type, fitted with oil circulating pumps and cooling fans automatically controlled to operate at a predetermined temperature. There are two 12,500 kVA, 66/11 kV transformers also of the outdoor oil-cooled type and with automatically controlled oil circulating pumps to provide a high emergency overload rating. Automatic control of the voltage on the 11 kV terminals is provided.

The 66 kV outdoor type oil circuit-breakers are of the three tank design with a proved short-circuit making and breaking capacity of 13,100 A at 66 kV.

Group inspecting the new Driffield primary substation of the Yorkshire Electricity Board. Left to right: Mr. J. D. Nicholson (chief engineer, Y.E.B.), Ald. Miss H. M. Padgett, J.P. (Mayor of Bridlington), Councillor H. A. Aldred, J.P. (chairman, Driffield U.D.C.), Mrs. H. A. Aldred, Mrs. H. Padgett (Mayoress of Bridlington), Mr. T. Stephenson, C.B.E. (clerk to the East Riding County Council), Mr. D. Bellamy, O.B.E., D.L. (chairman, Y.E.B.), Mr. Arthur Bond (deputy chairman, Y.E.B.) and Mr. A. Hornby (clerk to Driffield U.D.C.)



The 11 kV indoor oil circuit-breakers have a proved making and breaking capacity of 13,100 A at 11 kV.

The load in the area to be supplied from Driffield will have increased from about 12,000 kW in 1948-49 to about 32,000 kW in 1958-59.

Dispute with Farmer Settled

The Central Electricity Authority announces that an agreement has been reached to dispose of the litigation between it and Mr. Dudley Glanfield in relation to the placing of a tower and cables of the Authority's 275 kV supergrid line on Mr. Glanfield's land at Russells Farm, Windlesham, Surrey. Mr. Glanfield withdraws his claim and his allegations against the Authority of wrongful entry on his land and admits its right to act on the consent granted by the Minister of Fuel and Power to the placing of a tower and cables on his land and under the order made by the Minister authorising tree-cutting. The Authority withdraws its counter-claim.

The two parties have invited the Minister of Power to give further impartial consideration to the question of the siting of the line over Russells Farm. In the meantime, the Authority will not do any further work at Russells Farm until the Minister has considered the matter. If the Minister considers it desirable that the line should be re-sited, the Authority will, subject to an agreed contribution to be paid by Mr. Glanfield, surrender the consent and order which it has at present from the Minister and alter the course of the line as may be indicated by the Minister.

Kirkcaldy System Reinforcement

Approval of a £104,000 reinforcement scheme to meet the growing electrical load at Kirkcaldy has been announced by the South of Scotland Electricity Board. The scheme provides for the siting in the southern part of the town of a new substation

to be supplied from Glenniston via Seafield Colliery. The voltage in the areas to be supplied from this new substation will be increased from 6·6 to 11 kV. Other ancillary work is included in the scheme, which is scheduled for completion during the winter of 1958-59.

Holy Island Supply Decision

The Norham and Islandshire R.D.C. has been informed that the Minister of Power has ended the deadlock between the Northumberland Planning Authority and the South of Scotland Electricity Board over the supply to Holy Island and that work on the project is to begin shortly.

A public inquiry was held into the scheme but the Planning Authority and Board were unable to reach agreement on the route of the overhead and underground cables. The Board pointed out that the delay had resulted in an increase in the estimated cost and any further price rise would make the scheme uneconomical.

New Exeter Bulk Supply Point

Work has begun on the construction by the South Western Electricity Board of a new 33 kV bulk supply point at The Basin, Exeter. This new "packaged" substation is the first of its kind to be built in the South West. Mr. G. J. Websdale, the Board's Devon Sub-Area engineer, said in Exeter last week that this was part of a £54,000 scheme planned by the Board to meet the growing demand for electricity in Exeter. The new bulk supply point would also reinforce and improve supplies to consumers living in the Okehampton area of the West Devon District and all over the East Devon District; it would also provide greater security of supply in the area.

The substation will consist of ten interlocking metalclad units, five of which have just been erected on a concrete frame foundation in four days—a new record for this type of construction work. These "packaged" substations are factory-built (by methods resembling the automobile production line) at the South Wales Switchgear works, and the units were brought to Exeter by road.

Over 1¼ miles of 33 kV cables will be laid underground from the bulk supply point into the city, after being run across the canal and river.

OVERSEAS

Uganda Electricity Bonds

Electricity Development Bonds for 20s and 100s and upwards, providing a new form of saving in Uganda, are now being offered for sale at all of the offices of the Uganda Electricity Board. A 20s bond is worth 26s after five years. Interest and repayment are guaranteed by the Uganda Government.

The Board points out that this method of saving provides a unique and worthwhile opportunity for small as well as large investors to have some stake in Uganda's largest enterprise. So far there are only just over 18,000 consumers in Uganda, but new schemes for the distribution of electricity from Mityana to Mount Elgon will bring electricity within the reach of many thousands more. The Board is only on the fringe of electrical development and of providing supplies to the 5½ million population. For this more money is needed. The amount of capital which can be obtained from overseas is strictly limited and if more capital can be provided locally in East Africa more extensions can be carried out.

Full details of the bonds can be obtained from the Board's London representative, 27, Regent Street, London, S.W.1.

Atomic Power in Australia

It is stated that plans for the first Australian nuclear power station may be laid within the next year or two. For Australia, with its widely spaced centres of industry, nuclear power is particularly attractive.

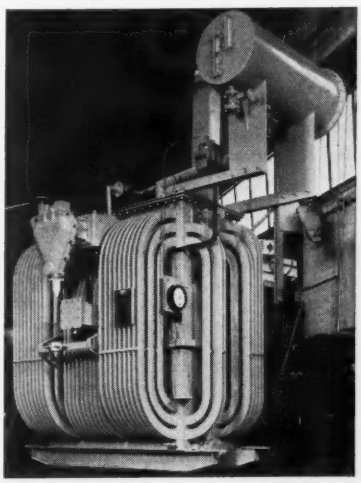
Higher Surplus in N.S.W.

The operations of the Electricity Commission of New South Wales during the year ended 30th June, 1956, resulted in a surplus of £659,964 from income of £33·4 million. This was the third successive year in which income exceeded expenditure, previous surpluses having been £446,261 in 1953-54 and £289,850 in 1954-55. The surplus has been applied to eliminating the accumulated deficit, leaving a small balance which has been transferred to general reserve. Sales of electricity totalled 4,547 million kWh, an increase of 421 million kWh or 10·2 per cent.

Notwithstanding general increases in the cost of services and materials, the average price of electricity sold showed little change (1·742d against 1·741d per kWh). It is expected that 244 MW of generating plant will be commissioned during 1956-57.

Electricity distributing councils in New South Wales have been informed of the details of a revised fuel and labour variation clause affecting the Electricity Commission's bulk energy charge. The effect of this will be to pass on to the councils savings in coal transport costs achieved by the generation of electricity at new power stations close to the coalfields. The new stations are Tallawarra, Lake Macquarie and Wallerawang.

Previously a coal index figure affecting the bulk energy charge was obtained from the cost of coal delivered to two representative metropolitan stations, Bunnerong and Pyrmont. The basic two-part bulk tariff is unchanged, but the fuel variation will now reflect the cost of coal delivered to all power stations.



One of a number of 750 kVA and 1,500 kVA transformers supplied by Foster Transformers, Ltd., for Kuwait "B" power station. The engineering consultants to the Ruler of Kuwait are Messrs. Ewbank & Partners

PARLIAMENTARY REPORT

Telephone Cancellations

In reply to Mr. Russell, the Postmaster General (Mr. Marples) said that between 18th July, when he announced increased charges for telephones, and 26th July about 20,000 withdrawal notices were received. The previous average, for the same length of time, was 4,500. Also 2,000 outstanding applications for telephones were cancelled between 18th and 26th July, this being 200 more than the previous average.

Electronic Telephony

Lady Gammans asked the Postmaster General what plans he had for the application of electronic techniques to telephone switching.

Mr. Marples said that electronic directors for routing calls within the London telephone system had been working successfully at the Richmond exchange for five years, and improved electronic equipment of this kind would shortly be in use at Lee Green. When the Bristol subscribers had their own trunk dialling facilities in 1959, the equipment which controlled the routing of the calls and the charges would be electronic. Like ourselves, other countries were working hard on the development of a fully electronic public telephone exchange. He was happy to announce that, as the result of joint research and development by the Post Office and the telecommunications industry of this country, we should have one here in the spring of 1960. Plans were made, and work would soon begin, to provide at Highgate Wood in London a prototype electronic exchange, giving service to over 1,000 subscribers.

Water Power in British Guiana

Replying to Mr. James Johnson, the Secretary of State for the Colonies (Mr. Lennox-Boyd) said the report on the hydro-electric investigation in British Guiana carried out by the Demerara Bauxite company stated that hydro-electric development at Great Falls, Mallali and Tiger Hill was technically feasible but the cost would be high. In consequence, the company had reluctantly decided, on economic grounds, that it could not proceed further with its application for a licence to develop hydro-electric power at these sites. The company was continuing its investigations into the possibilities of the Kaieteur-Amatuk area.

Deferment of Graduates

The Minister informed Mr. Sorensen that on 1st April the number of science and engineering graduates whose national service was deferred because they were engaged on priority work was about 3,100. They were required to remain in the employment for which deferment had been given until they ceased to be liable for national service on reaching the age of 26. As long as they had an undischarged liability for national service he felt it was right that they should remain in the specially important work for which they had been granted deferment.

Purchase Tax Anomalies

Dame Irene Ward asked the Chancellor what inquiries he was conducting into the anomalies of purchase tax.

Mr. Enoch Powell, Financial Secretary, Treasury, said the points raised in the debates on the Finance Bill were being examined.

Co-ordination of Road Works

Captain Pilkington asked the Minister of Transport what arrangements existed for the co-ordination of repairs in towns and cities between the various services, such as electricity, gas, water and telephone, to obviate the same street being dug up each time for each separate service.

Mr. Harold Watkinson said that highway authorities normally consulted the statutory undertakers to ensure that works on all the mains likely to require repair were completed before a road was re-surfaced, and that alternative routes were not dealt with simultaneously. In London there was a statutory procedure to secure the necessary co-ordination.

Clean Air Council

Mr. Philips Price asked the Minister of Housing and Local Government how many meetings of the Clean Air Council had taken place since its establishment.

Mr. Brooke said the Council had held one meeting, which took place on 11th July. The principal subjects of discussion were the actions taken since the passing of the Clean Air Act, and research and development work on air pollution problems. The Council proposed to meet next in the autumn.

Electricity in Hospitals

Mr. Ellis Smith asked the Minister of Health how far alternative sources of electric power were available in the hospitals within the city of Stoke-on-Trent.

Mr. Vaughan-Morgan, Parliamentary Secretary, said that all hospitals with operating theatres had arrangements for emergency electricity supply to the theatres. He was satisfied that there was adequate skilled staff for the routine maintenance and inspection of hospital electrical services.

Nuclear Research

Dr. Reginald Bennett asked the Prime Minister what had been achieved by the National Institute for Research in Nuclear Science since its establishment in the early part of this year.

Mr. Macmillan said the first task of the National Institute had been to examine the proposals for the construction of a new particle accelerator to permit further development of nuclear research. The design for this machine, a 7,000 MeV proton synchrotron, had now been agreed and work on its construction had been put in hand. The machine, which was expected to cost about £7 million, would be built on a site to be made available by the Atomic Energy Authority adjacent to its Research Establishment at Harwell.

Inflation and Exports

Sir William Robson-Brown asked the President of the Board of Trade what was his estimate of the extent to which our competitive trading position overseas had been affected since 1950 by the internal rate of inflation.

Mr. Derek Walker-Smith, Minister of State, said that if our costs had not increased we should have had a larger export trade, but it was not possible to make any quantitative estimate of the trade lost through inflation. There was some evidence that our prices had been on the whole in line with those of our competitors, but the effects of inflation were not limited to prices.

Parliament and Nationalised Industries

Speaking against the motion that the House of Commons should adjourn for three months for the summer recess, Sir David Robertson, M.P. for Caithness and Sutherland, said that two months' holiday would be enough. Then, perhaps, the House might be able to debate the nationalised industries, which were exerting great inflationary pressures on the economy. The North of Scotland Hydro-Electric Board was created by the Hydro-Electric Development (Scotland) Act, 1943, yet the House had not had one debate on the Board's reports and accounts.

Replying for the Government, Mr. R. A. Butler, the Lord Privy Seal and Leader of the House, said that under present arrangements three days were allotted to the nationalised industries in each Session, the choice being left to the Opposition.

Mr. Nabarro interrupted to say that the report and accounts of the National Coal Board were always discussed nine to twelve months after they were issued which made the debates valueless.

Mr. Butler replied that it was hoped to debate some of the nationalised industries early in the next Session (which is expected to begin on 5th November). If the Government could find the House further opportunities they would do so.

Financial Section

STOCKS and SHARES

INTEREST in Stock Exchange markets tends to go out with the tide of holiday-makers in this month of the year, but a good deal of it is being held this time by the further signs of recovery in Government securities. By the time of the Bank Holiday, the price of War Loan had drawn clear of last month's all-time low mark by a full two points. Best support in the gilt-edged market was forthcoming for the medium-dated issues such as 3 per cent British Electricity Stock, 1968-73, at around 74, which guarantees a tax-free capital profit of some 26 points (or 35 per cent on the money) to the buyer upon the eventual repayment of the stock at 100. With equity investments inclined still towards the dull side, the gap between the gilt-edged and industrial markets has in consequence narrowed appreciably in the past few weeks.

Vactric

This year's rise from 13s to 20s in the price of Vactric 5s shares has been among the best features in the electrical market. Earnings in the twelve months ended last March were described at the annual meeting as the best ever achieved by the company. Trading conditions were difficult for those sides of the business affected by the hire-purchase restrictions on domestic electrical appliances, but the loss of profits there was more than countered by much better results from other activities, notably the manufacture of precision tools and control equipment. After the deduction of larger provisions for depreciation and reserves, the net surplus came out some £13,000 higher at £257,000, which covers between three and four times over the ordinary dividend of 25 per cent (against 17½ per cent previously). A yield of 6¼ per cent is offered by the shares at their present price.

Hoover's Interim

In announcing the maintenance of the interim dividend for the current year at 10 per cent, Hoover, Ltd., reports that in the six months to last June sales in the home market were some 16 per cent above those in the same period of last year, when business was being unduly affected by the Government restrictions. Turnover is still described as unsatisfactory, however, in comparison with 1955 levels. It is expected to continue at about the present rate for the second half of the year, but the continuous rise in wages and other costs will, it is stated, put pressure on profits unless it is passed on to the consumer, a course which the company is clearly very reluctant to take. Provisionally, the group profit for the six months is reported as £1·68 million, against £1·03 million for the first half of 1956, and £2·79 million for the whole of 1956. The shares were quoted lower, at 38s 6d, after the announcement.

Earnings and Distributions

Company reports issued in recent months have continued to underline the tendency for profits to be squeezed between the rise in production costs and the effort to hold down selling prices. In some prominent instances the contraction has been severe enough to reduce net earnings to the point at which the dividend needs to be cut, even although there have been increases in production and sales. These events have raised the importance of one of the main factors in the assessment of any given ordinary share, namely the margin which exists between the amount distributed in the current dividend and the net surplus of profits available for that purpose and for reserves. The extent to which a dividend is shown in this way to be conservative or otherwise has, of course, a substantial influence over the yield basis on which the share concerned is quoted.

Dividend Cover

In the following table of shares in electrical and associated companies, the earnings of each in its last financial year (and in the previous period for purposes of comparison) are expressed as a gross percentage of the ordinary capital ranking for the dividend. In other words, these are approximately (subject to profits tax) the rates which could have been paid if the whole surplus of profits had been paid out. The rate of the dividend paid is shown, so that the present earnings "cover" for the distribution can be measured between the figures in the last two columns:—

Company	Earned %		Div. %
	Previous	Last	
A.E.I.	56	22 (a)	15
Auto. Tel.	66	63 (a)	17
Babcock & Wilcox	64	50	15
B.I.C.C.	54	38	12½
Chloride Elec.	44	41	17½
Clarke Chapman	158	184	27½
Cole, E. K.	64	58	17½
English Elec.	36	39	14
Ericsson	60	65	22
Ever Ready	99	101	37½
G.E.C.	33	22 (a)	12½
Henley's	25	13	11½
Intnl. Comb.	50	55	22½
Lancs. Dynamo	26	23 (a)	11
Laurence, Scott	69	75	15
L.E.W.	40	40	12½
T.C. & M.	14	11	8½
Vactric	92	95	25
Allen West	44	47	15

(a) On increased capital.

Conservative Payments

Some of the above comparisons between earnings in the latest and the previous years, it will be noted, are affected by increases in the amount of capital ranking for dividends. A main point of interest emerging from the figures is the fact that in more than half these cases, taken at random, the current rate of dividend is covered at least three times by the earnings available: that is to say, two-thirds or more of the latest profits have been retained in these businesses. Particularly conservative dividend policies are represented in the instances of Clarke Chapman and Laurence, Scott (who have since issued new capital) and comparatively moderate yields on the shares concerned indicate also the weight given to this consideration in their market valuation.

Motor and Electronics

Despite unfavourable conditions affecting the group's motor component division last year, the trading profits of Motor & Electronics Corporation at £225,000 came out within a few hundreds of the previous year's figure. The dividend was maintained comfortably at the total of 20 per cent which has been paid for the last eight years on ordinary capital increased over that period from £125,000 to £250,000. At the annual meeting the chairman reported an upswing in demands from the electrical and electronics industries, an improving order book and capacity working. He expressed concern over the effects of successive wage increases on production costs, but was confident about the long-term future of the industry. The company's 1s ordinary shares have been quoted lately at about 3s, the yield at this price being 6⅔ per cent.

Because of the August Bank Holiday we are unable to publish our share list. It will appear as usual next week.

Southern Areas Group Changes

The Southern Areas Electric Corporation, Ltd., announces changes of title, and production and sales plans, affecting two of its group subsidiary companies. The name of Gillott Electro Appliances, Ltd., has been changed to New Day Electric, Ltd., and, at its factory at Chalford (Glos.), this company will be the sole manufacturer of domestic electrical appliances in the Southern Areas group. In line with this change, New Day Electrical Accessories, Ltd., is being merged into New Day Electric, Ltd. Its products, which had outgrown the capacity of its Birmingham factory, will be transferred to Chalford which now becomes the address of New Day Electric, Ltd. Technical personnel are being transferred from Birmingham. This, coupled with expansion recently completed to the Chalford factory and projected new building extensions thereto, will permit consolidation and streamlining of existing production and acceleration of new products now under development. The trade name for all products from the Chalford factory is "Newday."

REPORTS and DIVIDENDS

Ward & Goldstone, Ltd.—The main figures in the accounts for the year ended 31st March last were given in our issue of 26th July. In his circulated statement, Mr. S. Goldstone (chairman and managing director) says that notwithstanding the retarding effect of various restrictions imposed on industry in the earlier part of the year, with slight relaxation in the closing months, a substantial overall increase in the volume of physical output has been achieved and profit on an increased turnover more than maintained. With greater production and higher efficiency, many items of increased expenditure have been absorbed, selling prices held or reduced, and competitive powers strengthened.

The directors consider that, in view of the accretion and consolidation of the finances of the company, the issued capital should reflect more accurately the amount of money invested in the business and, with the permission of the Treasury, recommend the creation of 2,000,000 "A" ordinary shares (non-voting) of 5s and the issue of 1,383,754 such shares by capitalisation of £345,938 10s from retained profits. The new shares will be allocated to ordinary stockholders in the ratio of one new share for every ordinary stock unit held; they will not be entitled to participate in any dividend in respect of the year ended 31st March last. The capitalisation does not imply any greater distribution.

Hoover, Ltd.—In declaring interim dividends of 6d per share on the ordinary and "A" ordinary shares, the directors state that the financial results for the first half of the current year show that the general improvement in the first quarter, indicated at the annual meeting, has continued during the whole period under review. Sales in the home market for the six months have improved by 16 per cent, as compared with the same period last year, but the turnover is still far from satisfactory when compared with the pre-credit restrictions period of 1955. Exports from this country are up by 3 per cent, and in the overall export field the turnover, including manufacture in Australia, France and Finland, is up by 7½ per cent. The prospects for the second half of the year indicate that turnover will continue at about the same level or possibly a little higher, but this is clouded by steadily increasing costs.

Vent-Axia, Ltd.—Resolutions to create 7,600,000 ordinary shares of 1s each and to effect a two-for-one scrip issue capitalising £131,200, were passed at a meeting held on 30th July.

Efco, Ltd. (formerly the Electric Furnace Co., Ltd.), reports a group profit for the year ended 31st March last of £226,840, as compared with £173,897 for 1955-56. Taxation absorbs £102,957 and the net balance is £123,883 (£97,539). It is proposed to pay a final dividend of 8½ per cent on increased capital, maintaining the distribution for the year at 12½ per cent.

Stothert & Pitt, Ltd., are making a one-for-two scrip issue capitalising £500,000 of reserves in £1 ordinary shares. The new shares will not rank for any final dividend which may be recommended in respect of the year ended 30th June last.

New Companies

I.D.M. Electronics, Ltd.—Registered 1st July. Capital £10,000. To enter into two agreements (1) with Electro Tec. Corp. (incorporated in New Jersey, U.S.A.) and (2) with G. J. Pandapas and I. M. Floor, relating to the development and exploitation of the patent processes, methods, techniques and formulæ mentioned in the said two agreements, and to manufacture and deal in electrical, electronic and industrial equipment, etc. Directors: I. M. Floor, T. M. Lavery, G. J. Pandapas, M. Naylor-Leyland and B. M. Wellesley-Wesley. Regd. office: Essex House, Essex Street, W.C.2.

Electronic Heaters, Ltd.—Registered 22nd July. Capital £6,000. To acquire the secrets of an invention relating to heating derived from electricity and certain patent rights granted to W. E. Watson under provisional patent No. 2748 of 25/1/57, and to carry on the business of manufacturers and marketers of the said invention, etc. Directors: A. L. Johnson and W. E. Watson. Regd. office: 1, Wedgewood Villas, Ford Park, Plymouth.

J. H. Walton, Ltd.—Registered 25th July. Capital £1,000. Electricians, electrical contractors, electrical engineers, etc. Directors: J. H. Walton, J. H. Walton, jnr. and Mrs. Nancy P. Walton. Regd. office: 29, Blackburn Road, Great Harwood.

Electric Washer Services, Ltd.—Registered 11th July. Capital £3,000. Manufacturers and repairers of and dealers in dynamos, motors, electric washing machines, etc. Directors: A. B. Hinchliff and Mrs. Elizabeth Hinchliff. Regd. office: Weetwood Chambers, Albion Street, Leeds.

Tele-Auctions (Leeds) Co., Ltd.—Registered 27th June. Capital £1,000. Auctioneers of television and radio apparatus and electrical appliances and equipment, etc. Directors: A. D. Hey-Shipton and B. C. T. Blackburn. Regd. office: Corporation Chambers, Trinity House Lane, Hull.

Ransoms Television, Ltd.—Registered 16th July. Capital £40,000. Designers and manufacturers of and dealers in radio, television, electrical, electronic and telephone apparatus, etc. Directors: H. G. A. Ransom, H. F. Hawkins and F. J. R. Dodd. Regd. office: 34, Bond Street, Brighton, 1.

Moore Developments, Ltd.—Registered 12th July. Capital £1,000. Electrical and electronic engineers, engaged in research, design, development and manufacture of circuits, microwave instruments, etc. Directors: L. E. Moore and Mrs. Joyce I. Moore. Regd. office: 167, High Street, Guildford.

Summerfields Electrical, Ltd.—Registered 31st May. Capital £1,000. Manufacturers of and dealers in electrical goods and apparatus of all kinds, etc. Solicitors: Varley Hibbs & Co., Coventry.

Allwood & Langler, Ltd.—Registered 25th April. Capital £1,000. Electrical engineers and contractors, etc. Directors: C. M. F. Allwood and R. Langler. Regd. office: 55, Hyde Road, Paignton, Devon.

Wilfred Pemberton (Cardiff), Ltd.—Registered 2nd May. Capital £2,000. Electrical engineers and general electrical installation contractors, etc. Directors: Wilfred Pemberton and Eunice M. Pemberton. Secretary: W. Pemberton. Solicitors: Edward T. Davies & Sons, Pontyclun. Regd. offices: 96, Bute Street, Cardiff.

Chevronic, Ltd.—Registered 10th July. Capital £500. Manufacturers of and dealers in radio, television and electronic equipment, etc. Directors: B. Dorfman and A. Johnson. Regd. office: 265-75, Martins Bank Building, Water Street, Liverpool.

W. A. Hughes, Ltd.—Registered 10th July. Capital £100. Manufacturers of and dealers in electrical appliances and equipment, etc. Directors: W. A. Hughes and Minnie B. Hughes. Regd. office: 28, Kennedy Street, Manchester, 2.

Butcher and Miskin, Ltd.—Registered 10th July. Capital £10,000. Manufacturers of and dealers in radios, transmitting and television sets, etc. Directors: B. W. Butcher and R. H. Miskin. Regd. office: 17, Lower Belgrave Street, S.W.1.

Michael F. Kent & Co., Ltd.—Registered in Dublin 29th March. Capital £10,000. To acquire the business of electrical engineers and contractors carried on at 29, Parnell Street, Clonmel, Co. Tipperary, by the personal representatives of the late Michael F. Kent as Michael F. Kent & Co.

S. Stephenson, Ltd.—Registered 5th July. Capital £10,000. Electrical engineers, radio, electronic and mechanical engineers, etc. Directors: S. Stephenson, B. S. Stephenson and Dorothy S. Jarratt. Regd. office: 35, Manchester Road, Denton, Manchester.

E. J. Knight & Son (Electrical Contractors), Ltd.—Registered 5th July. Capital £1,000. Electrical engineers, general electrical installation contractors, manufacturers of and dealers in dynamos, motors, armatures, magnetos, etc. Directors: E. J. Knight and Mrs. Pearl Knight. Regd. office: 56, High Street, Blaina, Mon.

Liquidations

Northern Wholesale Electrical Distributors, Ltd.—Winding up voluntarily. Liquidator, Mr. F. R. Clarke, 66, John Street, Sunderland, appointed 24th July.

J. Alan Aspin, Ltd., electrical and general engineers.—Winding up voluntarily. Liquidator, Mr. E. G. Westmore, 68, Albert Road, Colne, Lancs, appointed 22nd July.

Bankruptcies

A. C. Allport, lately carrying on business at 2, Creek Road, March, Cambs, and at Outer Southgates, King's Lynn, Norfolk, under the style of Radio Repairs, as radio and electrical sales and repairs.—Public examination 18th October at the Law Courts, New Road, Peterborough.

R. Powell, lately carrying on business as an electrical goods retailer under the style of Domestic Electrics at 127, Newgate Lane, Mansfield, Notts.—Order made 28th June granting discharge subject to the debtor consenting to judgment being entered against him in the Chesterfield County Court for £75 and £1 10s costs payable by instalments of £2 a month. Trustee, Mr. K. A. Miller, 55, Queen Street, Sheffield, 1, Official Receiver, released 19th July.

V. F. Pitt, electrical engineer, sole general partner of V. F. Pitt, a limited partnership, registered pursuant to the provisions of the Limited Partnership Act, 1907, carrying on business at 54, Mortimer Street, Herne Bay.—Last day for receiving proofs for dividend 9th August. Trustee, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton, 1.

T. E. Jones, trading as Berrington Jones, at 138, Northgate Street, Chester, electrical engineer.—Supplemental dividend of 14s 8d in the £, making 20s in the £ in all, together with 4 per cent statutory interest, payable on and after 9th August at the Official Receiver's office, West Africa House, 25, Water Street, Liverpool, 2.

H. P. Merken, 22, Petherton Road, Highbury, London, N.5, electrical contractor.—Receiving order made 25th July on a creditor's petition.

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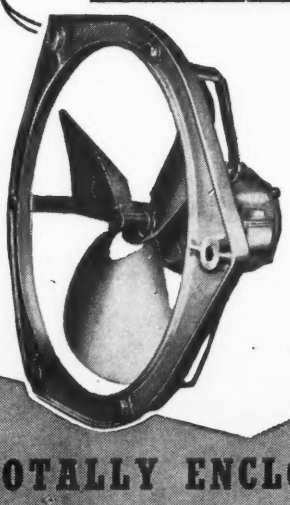

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Electrical Specifications Recently Published

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1952

4788. Elliott Bros. (London), Ltd.—Comparison and measurement of signals in electrical pulse systems. 22nd May, 1953. (781057.) 13195. Continuous measurement and recording of the conductivity of electrolytic solutions. 26th May, 1953. (781058.)

13962. Machlett Laboratories, Inc.—Gas-filled thyratron. 3rd June, 1952. (780959.)

32591. Minister of Supply.—Electric switching devices. 23rd December, 1953. (781260.)

1953

154. Philco Corporation.—Electrical systems. 2nd January, 1953. (781060.)

12677. Rogers, F. E.—Circuit for simulating a variable resistor by means of a variable reactor. 6th August, 1954. (781164.)

19569. Field & Son, Ltd., H. W., and Treby, F. L.—Supply equipment for low pressure electric discharge lamps. 3rd June, 1954. (780964.)

21027. Licentia Patent-Verwaltungs-Ges. —Arrangements for cooling of electric unsymmetrically conductive systems with semiconductive materials. 29th July, 1953. (781061.)

24397. Hilger & Watts, Ltd.—Measuring electrical potentials. 3rd September, 1954. (781167.)

30261. Muirhead & Co., Ltd.—Apparatus for the amplification of low level unidirectional electrical signals. 28th October, 1954. (780969.)

33037. Standard Coil Products Co., Inc. —Frequency selectors for receiving individual frequencies in the u.h.f. band. 27th November, 1953. (781064.)

34407. Cutler-Hammer, Inc.—Electric snap switches. 10th December, 1953. (780972.)

35416. Telefunken Ges.—Glass-to-metal seals. 21st December, 1953. (781066.)

1954

411. Laurence, Scott & Electromotors, Ltd., and Schwarz, K. K.—Load measuring and discriminating system for a.c. electrical machines. 6th January, 1955. (781067.)

951. Ekco Electronics, Ltd., Thompson, W. E., and Taylor, L. E.—Thickness measuring gauges using radioactive material. 13th January, 1955. (781068.)

6901/2/3. Benjamin Electric, Ltd.—Electric lighting fittings. 9th March, 1955. (781053/4/5.)

6934. Siemens Bros. & Co., Ltd.—Thermionic valve circuits. 7th March, 1955. (781175.)

7433. Telephone Manufacturing Co., Ltd.—Relays. 1st March, 1955. (781291.)

7790. British Thomson-Houston Co., Ltd.—Magnetron oscillators. 24th February, 1955. (781292.)

8412. Hazeltine Corporation. — Self-correcting pulse code communication system. 23rd March, 1954. (780947.) 8413. Synchronising control arrangement for pulse code communication system. 23rd March, 1954. (780948.)

10097. British Thomson-Houston Co., Ltd.—Electrical transmission line arrangement. 25th April, 1955. (780979.)

14382. Hazeltine Corporation.—Control apparatus for colour television receiver. 17th May, 1954. (781178.)

20601. General Electric Co.—Electric switching apparatus. 14th July, 1954. (780982.) 21140. Mass analysing apparatus. 20th July, 1954. (780951.)

22259/60/61. El-Re-Ma Soc. Anon. per lo Sfruttamento di Brevetti.—Electric calculating machines. 30th July, 1954. (780953/4/5.)

23989. Electric & Musical Industries, Ltd. —Electrical sound transmission systems. 9th August, 1955. (781186.) 23990. Circuit arrangements embodying pick-up tubes. 21st July, 1955. (781187.)

26900. Mond Nickel Co., Ltd.—Iron powder and the manufacture of magnetic cores therefrom. 8th September, 1955. (781081.)

29985/6. British Insulated Callender's Cables, Ltd.—Sealing glands. 17th October, 1955. (780945/6.)

30177. Marconi's Wireless Telegraph Co., Ltd.—Radio transmitters. 13th July, 1955. (781306.)

30481. Belling & Lee, Ltd.—Radio frequency inductor. 15th December, 1955. (781088.)

33010. Hellermann, Ltd. — Insulating means for electrical connectors. 22nd November, 1955. (780991.)

33786. Telegraph Construction & Maintenance Co., Ltd.—Sealing glands for electric cables. 22nd November, 1955. (780993.)

36403. Fordham Pressings, Ltd.—Charging units for electric fencing. 15th December, 1955. (781001.)

37514. Plessey Co., Ltd.—Electromagnetic control device for the periodic operation of electric switch contacts. 29th December, 1955. (781316.)

1955

165. United Kingdom Atomic Energy Authority.—Apparatus for use in welding concentric pipe assemblies. 3rd January, 1956. (781317.)

177. Clang, Ltd., Austen, H. E., and Harwood, C. D.—Terminals of pillar type for electric conductors. 4th January, 1956. (781003.)

477. Funditor, Ltd., and Strobel, A.—Electric heating units for melting pots. 6th January, 1956. (781098.)

986. Metropolitan-Vickers Electrical Co., Ltd.—Overheat electrical protection device. 30th December, 1955. (781198.)

1519. Philips Electrical Industries, Ltd.—High frequency decoupling elements for electric conductors. 18th January, 1955. (781320.)

2467/8. Westinghouse Brake & Signal Co., Ltd., and Lockett, L. J.—Electromagnetic relays. 16th January, 1956. (780956/7.)

3172. Mallinson, G.—Electric bed and similar heating and airing appliances. 3rd February, 1956. (781007.)

4149. British Thomson-Houston Co., Ltd.—Electromagnetic devices. 9th February, 1956. (781102.)

4596. Marconi's Wireless Telegraph Co., Ltd.—Continuously variable electrical line devices. 20th October, 1955. (781008.)

5274. Globe Industries, Inc.—Electric motors. 22nd February, 1955. (781107.)

6521. Compagnie Générale de Télégraphie sans Fil.—Travelling wave tubes. 4th March, 1955. (781205.) 7132. Travelling wave tubes of the magnetron type. 10th March, 1955. (781208.)

7998. General Electric Co., Ltd.—Electrodes for electric primary batteries. 20th March, 1956. (781109.)

9387. Marconi's Wireless Telegraph Co., Ltd.—Voltage stabilised supply systems. 24th October, 1955. (781015.)

9823. Oldham & Son, Ltd., and Prout, L. R.—Electric storage batteries. 6th March, 1956. (781112.)

10613. Clarostat Mfg. Co., Inc.—Electrical resistors. 13th April, 1955. (781113.)

11185. United-Carr Fastener Corporation.—Electrical wiring terminals. 18th April, 1955. (781114.)

12324. Automatic Electric Laboratories, Inc.—Alternative trunking in telephone systems controlled by overflow trunks and common directors. 28th April, 1955. (781020.)

12514. General Electric Co.—Mass spectrometers. 29th April, 1955. (780952.)

12545. Bendix Aviation Corporation.—Selective bridge amplifiers employing discharge tubes. 29th April, 1955. (781215.)

13967. Pettersson, G. A., and Kornfeldt, P.—Electromagnetic relays. 13th May, 1955. (781119.)

15723. Etablissements Merlin & Gerin Soc. Anon.—Supply and control systems of air-blast circuit-breakers. 1st June, 1955. (781120.)

17135. General Electric Co.—Electric sequencing control systems. 14th June, 1955. (781026.)

18341. Western Electric Co., Inc.—Electric pulse circuits utilising transistors. 24th June, 1955. (781222.)

18949. Olympic Radio & Television, Inc. —Indicator phase meter. 30th June, 1955. (781028.)

23492. Abbott, H. C., and McDermott, T. J.—Electrically heated mattress and sleeping pad. 15th August, 1955. (781130.)

24230. Kienzle Apparate Ges.—Electromagnetic switching devices for taximeters. 23rd August, 1955. (781036.)

24448. Pirelli Soc. per Azioni.—Branch joint for high-voltage electric cables. 25th August, 1955. (781129.)

28036. Ericsson Telephones, Ltd.—Electric couplings. 3rd October, 1955. (781133.)

28543. Automatic Electric Laboratories, Inc.—Telephone instrument utilising transistor amplifier. 6th October, 1955. (781135.)

29983. Buchanan Electrical Products Corporation.—Insulating cover for an assembly of a splice cap and electrical conductors. 20th October, 1955. (781137.)

32627. Western Electric Co., Inc.—Couplings for tubular members. 15th November, 1955. (781144.)

1956

4257. General Electric Co.—Electric terminal connector assembly. 10th February, 1956. (781246.)

6307. Westinghouse Electric International Co.—Electric reactors. 29th February, 1956. (781250.)

Street Lighting Plans

The Minister of Housing and Local Government, Mr. Henry Brooke, last quarter authorised local authorities to borrow £893899 for public lighting purposes.

Hebburn (Co. Durham) U.D.C. is seeking sanction to borrow £5,154 for converting street lighting from mercury vapour to sodium vapour.

Watford Highways Committee has received permission to borrow £2,794 for the lighting of part of Watford By-pass.

Boldon (Co. Durham) U.D.C. is seeking Ministry approval of a scheme for the provision of electric street lighting in the Station Road, East Boldon, Cleadon, West Boldon, Whitburn and Marsden areas. The cost will be about £10,500.

Longbenton (Northumberland) U.D.C. proposes to convert the remaining gas street lighting to electricity.

The borough engineer of **Middlesbrough,** Mr. J. A. Kenyon, has prepared a scheme for installing electric street lighting on the Easterside housing site. It is proposed to erect about 220 street lamps and the estimated initial cost of the project is nearly £14,000.

Sunderland Town Council has received loan sanction to £6,745 for the provision of street lighting on the Hylton Red House estate. The Council is to spend £2,900 on the provision of electric street lighting in Washington Road, Queen Alexandra Road and Ormonde Street, Sunderland.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Electricity Commission of New South Wales, Sydney. 9th September. Micro-wave wide band frequency modulated radio telephone apparatus. (E.S.B. 18634/57. Ten/27278.)*

State Electricity Commission of Queensland, Brisbane. 25th September. Nine 22 kV, 250 MVA and eight 11 kV, 250 MVA circuit-breakers. (E.S.B. 18350/57. Ten/27260.)*

Bailey.—Corporation. 28th August. Electric lamps. (See this issue.)

Burma.—Burma Purchase Board, Rangoon. 14th August. Six sets of electrically driven centrifugal pumping sets. (E.S.B. 18235/57. Ten/27181.)*

Canada.—Manitoba Hydro-Electric Board. 20th August. Two motor driven circulating water pumps. (E.S.B. 18451/57. Ten/27217.)* Eight 115 kV circuit-breakers. (E.S.B. 18408/57. Ten/27259.)*

Durham.—County Council. 17th August. Supply of stores, including electric lamps, for the year ending 31st August, 1958. (See this issue.)

Ellesmere Port.—Corporation. 24th August. Street lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 23rd August. Insulated cables. (E.S.B. 18398/57 I.C.A. Ten/27223.)*

India.—Mysore Government Stores Purchase Committee, Bangalore. 16th August. Two earthing transformers to be installed at "A" station, Bangalore. (E.S.B. 18340/57. Ten/27210.)*

Bombay State Electricity Board, Nagpur. 18th September. Coal handling plant. (E.S.B. 18040/57. Ten/27197.)*

Iran.—Ministry of Posts, Telegraphs and Telephones. 24th August. Two sending and two receiving stations for facsimile transmission by wireless. (E.S.B. 18200/57. Ten/27209.)*

Iraq.—Development Board and Ministry of Development. 14th October. Transformers, switchgear and accessories for Basrah power project. (E.S.B. 18617/57. Ten/27272.)*

New Zealand. — Wellington Electricity Department. 28th August. 650 V a.c. switchboards incorporating pillar-type feeder units. (E.S.B. 18229/57. Ten/27194.)*

Portuguese East Africa.—Beira Railways. 20th September. Transformer substation and expansion of the present kiosk at Gondola. (E.S.B. 15373/57. Ten/27158.)*

Ports, Railways and Transport Department, Beira. 30th August. Telegraph and telephone apparatus. (E.S.B. 17560/57. Ten/27211.)* 2nd October. H.v. electrical material. (E.S.B. 18395/57. Ten/27215.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 21st August. Steel poles. (E.S.B. 18266/57. Ten/27205.)* 23rd August. Lightning arrestors. (E.S.B. 18270/57. Ten/27192.)* 28th August. Electricity meters. (E.S.B. 18783/57. Ten/27292.)* Four-panel switchboard. (E.S.B. 18782/57. Ten/27283.)* 30th August. Telegraph line material. (E.S.B. 18781/57. Ten/27284.)*

Durban Corporation. 16th August. Telephone cable conduit. (E.S.B. 18578/57. Ten/27282.)*

Spain.—Hidroelectrica de Cataluna, S.A., Barcelona. 16th August. Tempered glass insulators and two circuit-breakers. (E.S.B. 18233/57 I.C.A. Ten/27190.)*

Sunderland.—Corporation. 22nd August. Electrical installations in 260 dwellings. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Acle. — Secondary modern school (£105,160), for Norfolk E.C.; Tooley & Youngs, builders, Stalham, Norfolk.

Acton.—Additional floor to science block, Brunel College of Technology (£79,230), for Middlesex E.C.; Prestige & Co., Ltd., builders, 149, Grosvenor Road, London, S.W.1.

Ayr.—Houses (200); Scottish Special Housing Association, Ltd., 15-21, Palmerston Place, Edinburgh, 12.

Birmingham.—Blakesley Road Junior and Infants' School, South Yardley (£99,700); A. G. Sheppard Fidler, city architect, Civic Centre, 1.

R.C. school, Handsworth; Morris & Whitehouse, architects, 5, Edmund Street.

Library and lecture theatre for University; Barlow, Leslie & Coombes, consultants, 5, Catherine Place, London, S.W.1.

Administrative offices, warehouse and factory premises in Chester Road, Erdington; Hardy Spicer & Co., Ltd., Birch Road, Birmingham, 6.

Bodmin.—Works and offices; D. E. Symons, Beacon Works.

Border.—Houses, Longtown (70) and Brampton (20); R.D.C. housing officer, Victoria Place, Carlisle.

Bourne End.—Houses (210); Cooper Estates, Ltd., Wilmington House, Wilmington, near Dartford, Kent.

Breconshire.—Comprehensive school at Rhydw, Brynmawr; county architect, Rhyd Offices, Brecon.

Brighton.—Factory extension; T. S. Precision Engineering, Ltd., Hollingbury.

Flats (72), Whitehawk estate (part of larger scheme); borough surveyor.

Bristol.—Multi-storey car park and office block, Baldwin Street site; city architect, College Green.

Darlington.—Five workshops, College of Further Education (£30,000); borough architect.

Extensions to factory, Dodswell Street; Henry Williams, Ltd.

Doncaster.—Flats (36), Cantley; borough architect, 15, South Parade.

Dunstable.—Civic centre, shops, market, etc.; borough engineer, Municipal Offices.

Edmonton.—Block of offices rear of Fore Street; Fuller, Hall & Foulsham, architects, 212, High Holborn, London, W.C.1.

Egham (Surrey).—Hostel for 70 students at Shoreditch Training College, Coopers Hill (£63,100) for L.C.C.; Architects' Department, County Hall, Westminster Bridge, London, S.E.1.

Exeter.—First instalment of scheme for central technical college (£112,450); Devon county architect, 97, Heavitree Road, Exeter.

Grantham.—Home for old people, Welby Gardens (£41,050); county architect, Sleaford, Lincs.

Extensions to multiple stores, 13-15, High Street, for Marks & Spencer, Ltd.; T. Mayer, staff architect, 82, Baker Street, London, W.1.

Herefordshire.—Further section of scheme for technical college, Folly Lane, Hereford (£145,800), hall of residence for students, Hereford Training College, and secondary schools at Bromyard and Ledbury; W. Usher, county architect, Bath Road, Hereford.

Ilford.—Baptist church, Claybury Park; John M. Smith, architect, 34, Balfour Road.

Lanarkshire.—Secondary and primary school at Chapelhall and junior secondary school at Orbiston, Bellshill; S. McColl, county architect, County Buildings, Hamilton.

Llangefni.—Factory; Cableform, Ltd., Romiley, Cheshire.

London.—Houses, Astell Street; Austin Blomfield, architect, New Court, Temple, E.C.4.

Shops and flats, 86/92, Lambs Conduit Street; Lander, Bedells & Crompton, architects, 36, Lambs Conduit Street, W.C.1.

Block of luxury flats, Lowndes Street, Westminster; Lowndes Lodge Property Co., Ltd., 48, Hertford Street, W.1.

Factory at 685-9, Old Kent Road; Purvis & Purvis, architects, 417, New Cross Road, S.E.14.

Maidstone.—Showrooms and offices, 45-47, Week Street; Highway Property Co., Ltd., 10-13, Dominion Street, London, E.C.2.

Manchester.—Hotel, Higher Blackley; C. H. Coppack & Partners, architects, 2, Upper Northgate Street, Chester.

Terminal building at Ringway Airport; city architect.

Merstham.—R.C. church; Justin H. Alleyn, architect, 1a, Berners Street, London, W.1.

Nottingham. — Civic library, Dryden Street/Shakespeare Street corner site, and branch libraries at Bilborough and Clifton estates; city surveyor, Guildhall.

Oxted.—Extensions to county school (£97,864); Y. J. Lovell & Son, Ltd., builders, Marsham Lane, Gerrards Cross, Bucks.

Southsea. — Pier buildings; Clarence Esplanade Pier Co., Ltd., 18, Landport Terrace.

South Shields.—Additional classrooms, science laboratories and handicraft rooms, Cleddon Park Secondary Mixed School; borough education architect.

Crematorium at Simonside (£69,000); borough engineer.

Stockton-on-Tees.—Houses (96), Albany Road; T. C. Hartley, borough architect, 28, The Square, Stockton.

Sunderland.—Houses (86), Lawrence Street; H. C. Bishop, borough architect, Grange House, Stockton Road, Sunderland.

Totnes.—New civic hall (£28,000); G. A. Jellicoe, architect, 12, Gower Street, London, W.C.1.

Twickenham.—Extensions (£285,000) at technical college; Walter Lawrence & Son, Ltd., builders, 31, Sun Street, E.C.2.

Walthamstow.—Warwick County Secondary School for Girls; Tooley & Foster, architects, Midland Bank Chambers, Buckhurst Hill.

Welwyn Garden City.—Houses (74) and flats (12) for U.D.C.; C. W. Fox, architect, 22, Parkway, Welwyn Garden City.

West Bromwich.—Factory and offices, Edward Street; Sing Arts, Ltd., 29, Victoria Street.

Works extensions; Auxiliary Rolling Machinery, Ltd., Whitehall Road.

Willesden.—Three-storey offices and staff-rooms, with four shops, 87-93, High Street; Unicos Property Corporation, Ltd., 43, North Audley Street, London, W.1.

Wood Green.—Extension, High Road, for British Home Stores, Ltd.; Demolition & Construction Co., Ltd., 3, St. James's Square, S.W.1.

Worcester.—County library headquarters in Love's Grove (£16,500); county architect, 14, Castle Street, Worcester.

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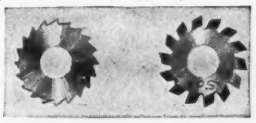

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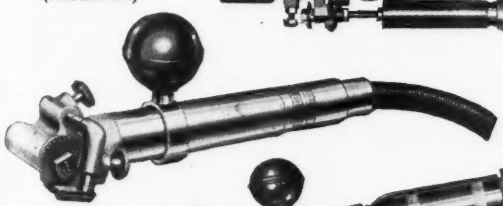

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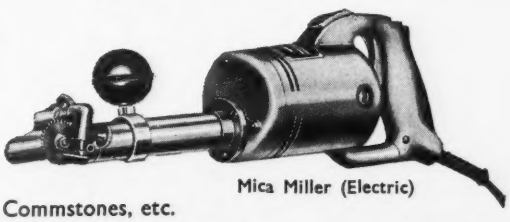

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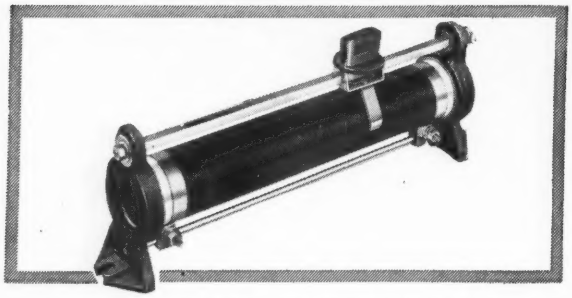

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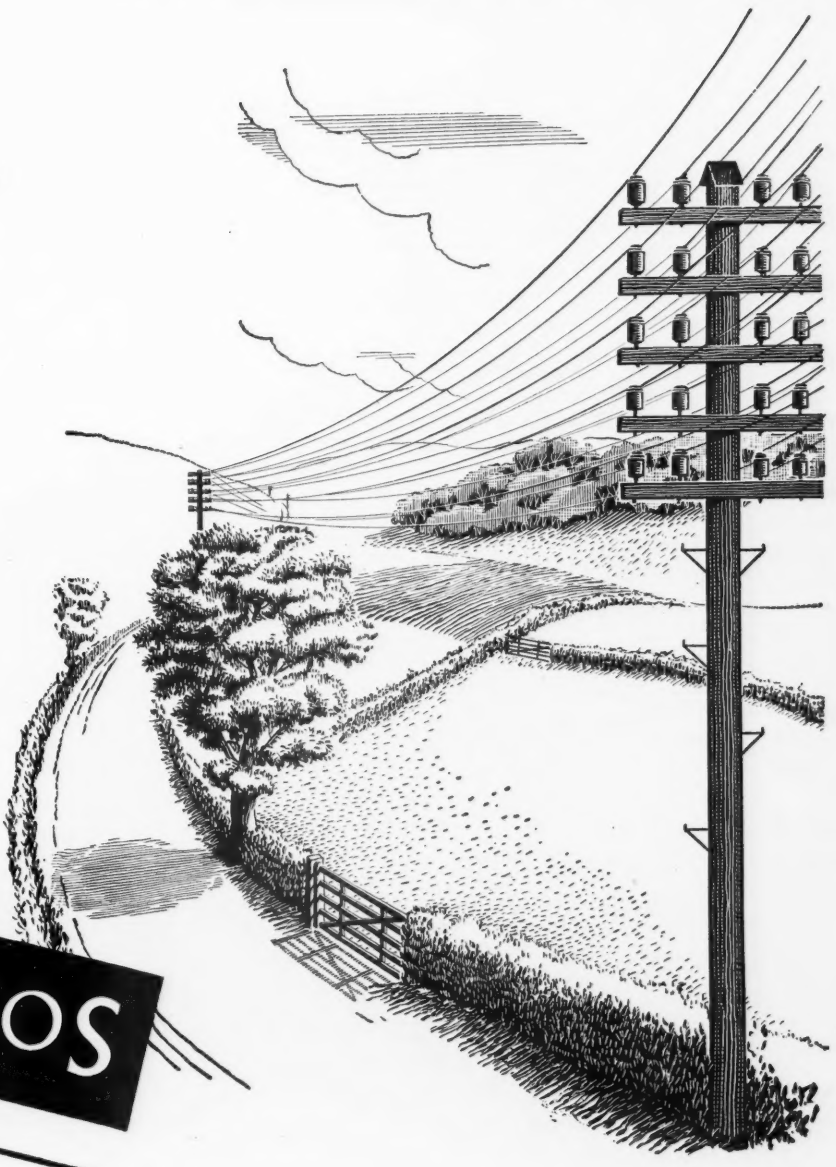

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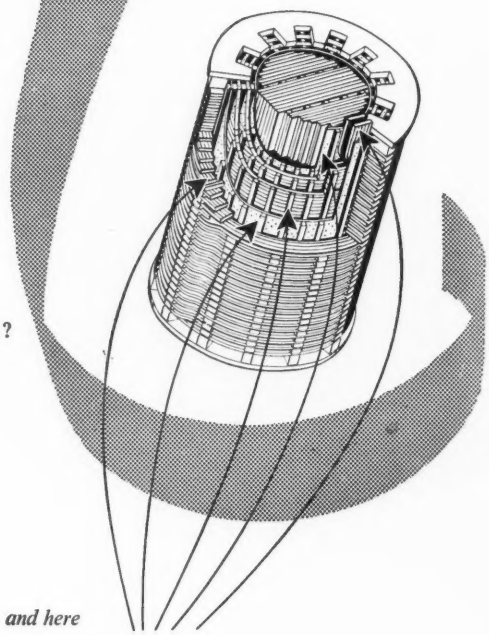

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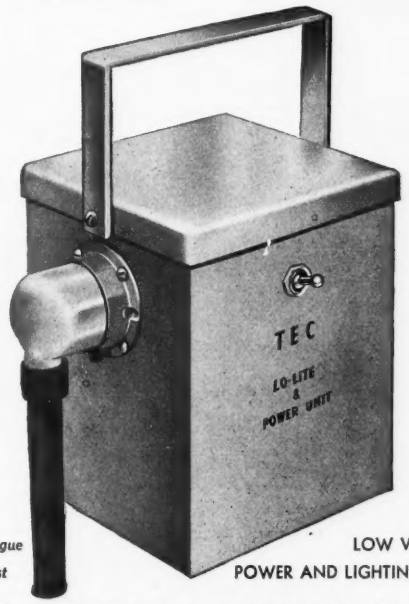

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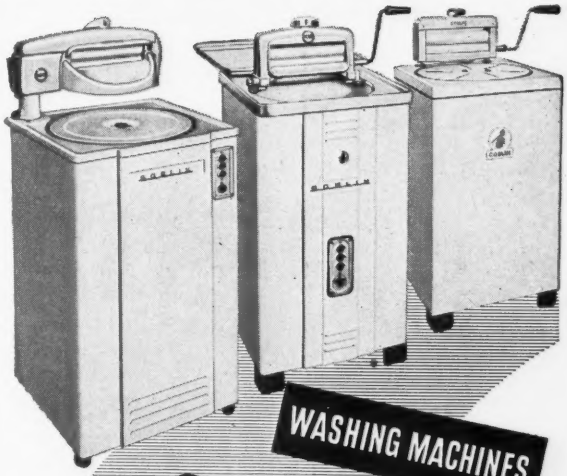

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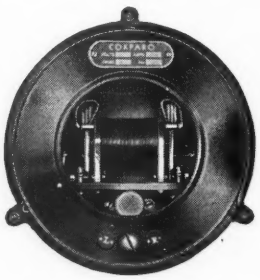

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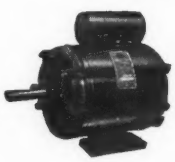

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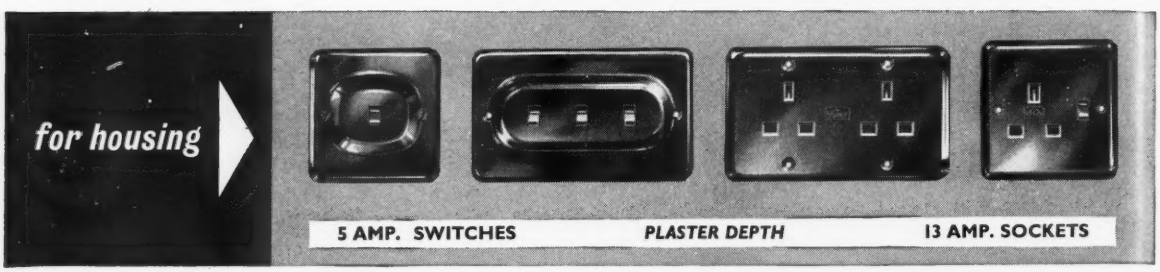

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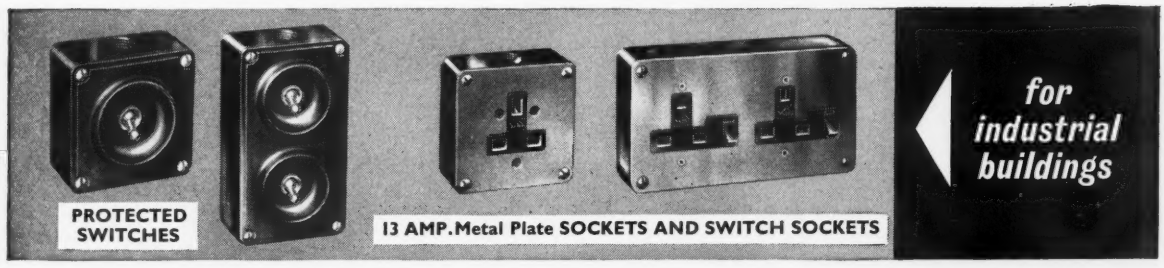

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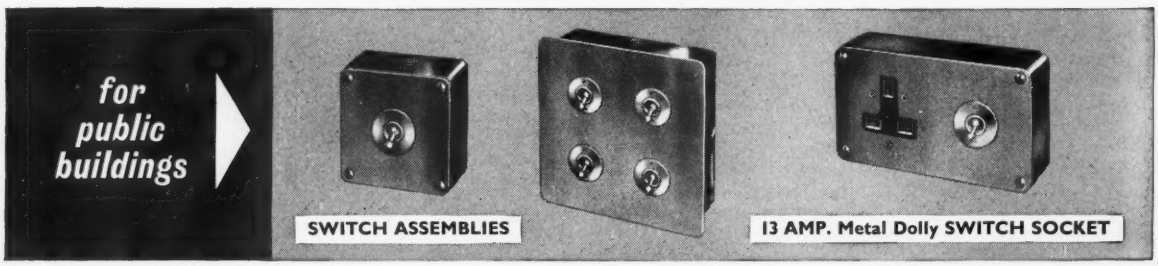

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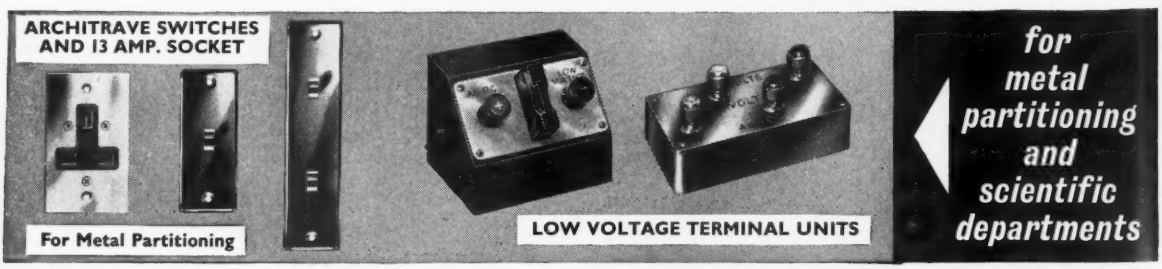
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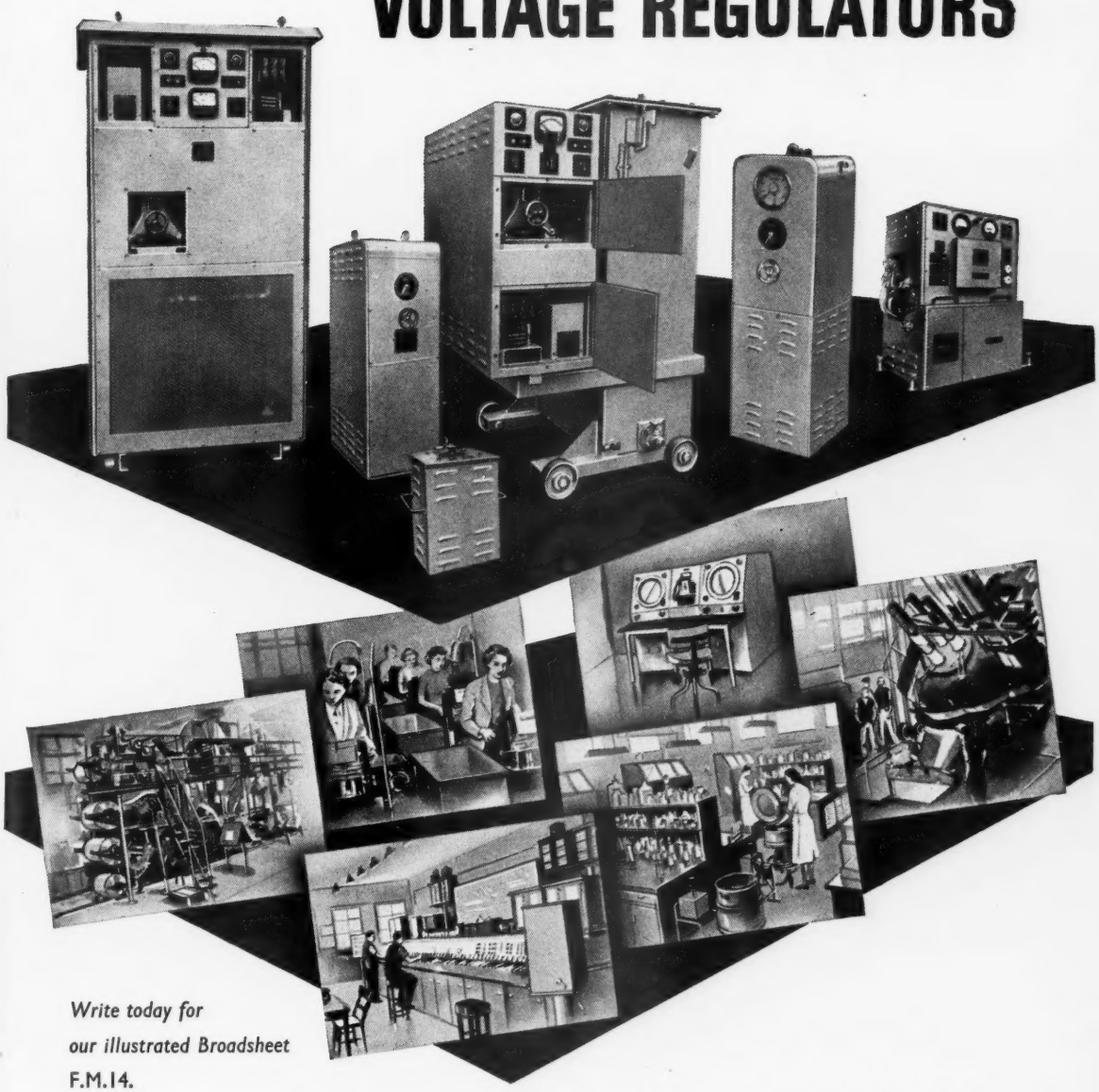

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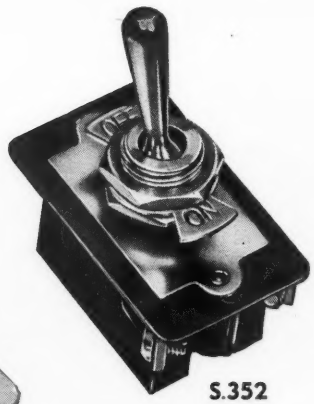
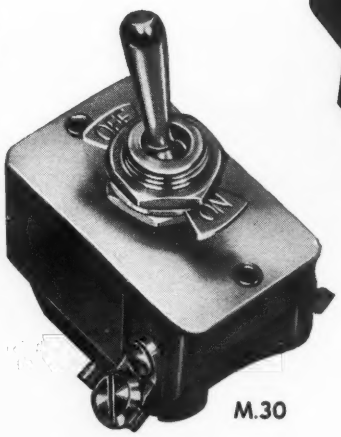


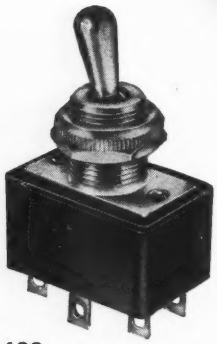
S.352



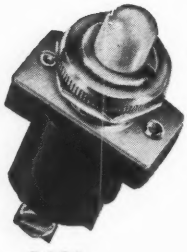
M.30

S.700

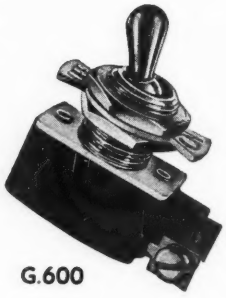
S.510



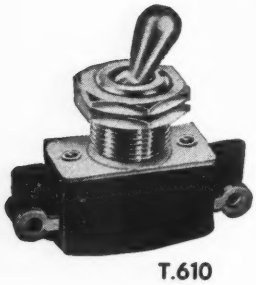
T.622



S.930



G.600



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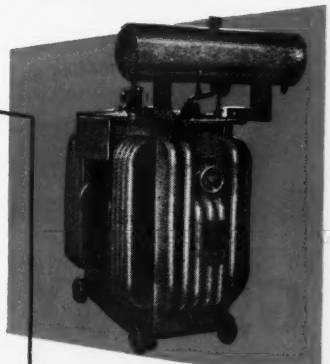

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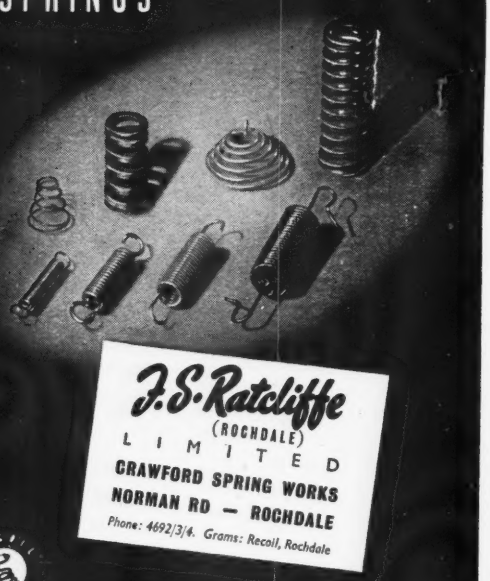

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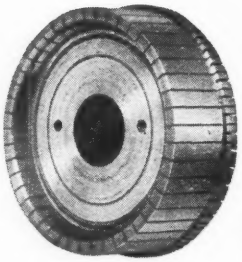

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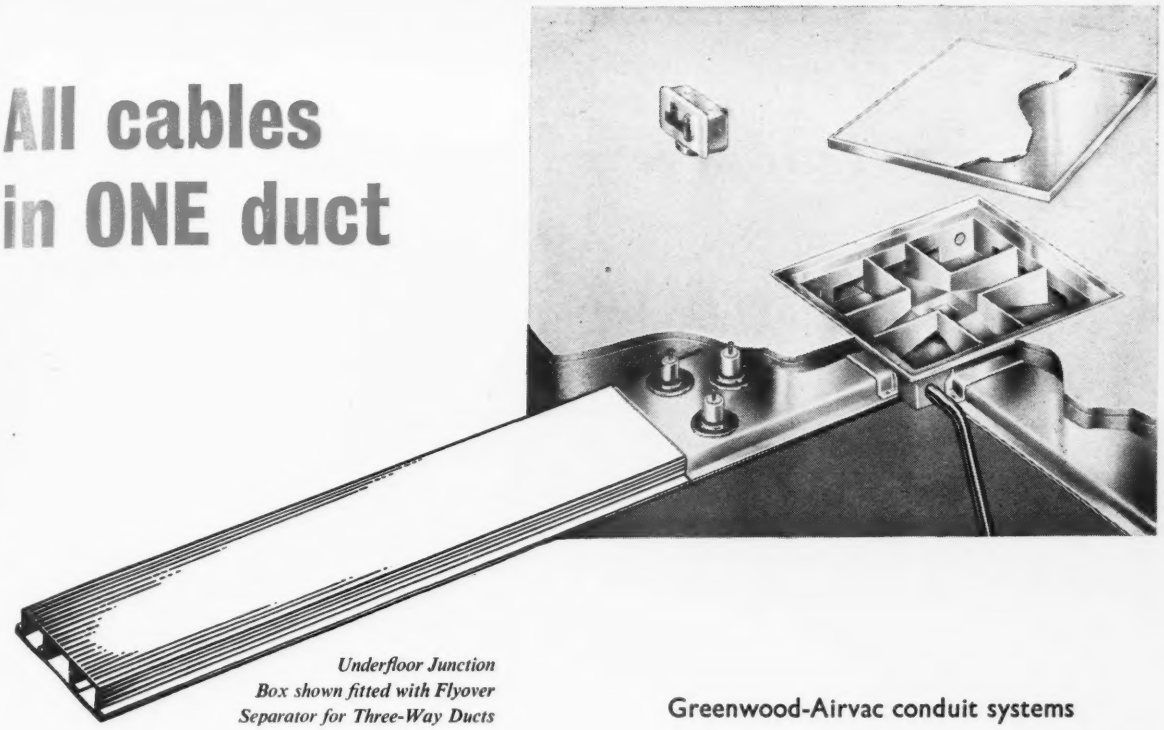

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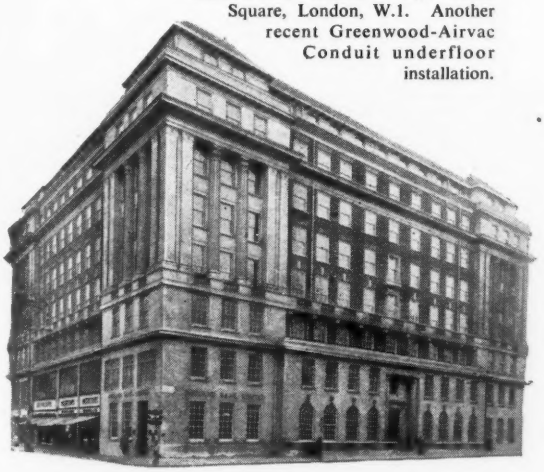

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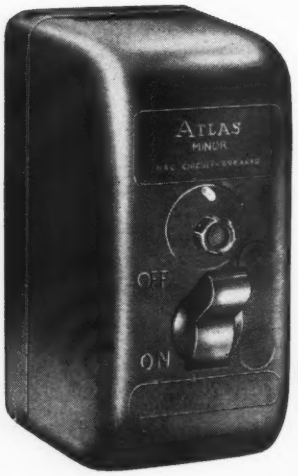

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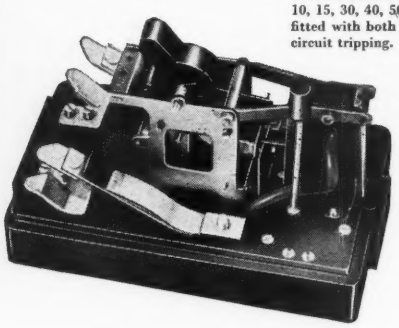

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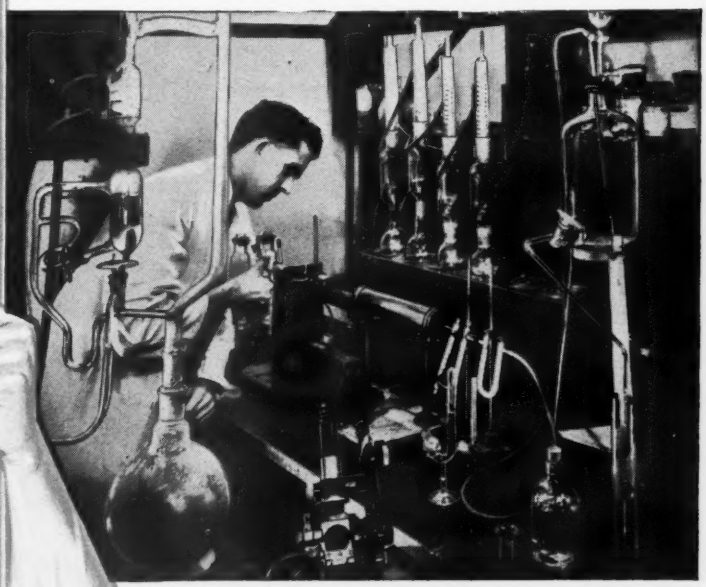

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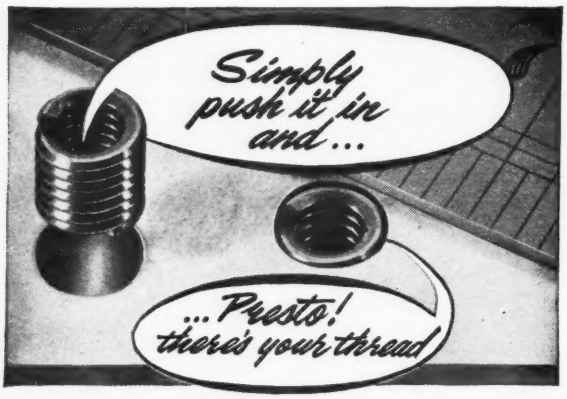

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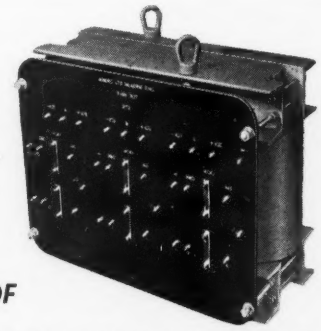

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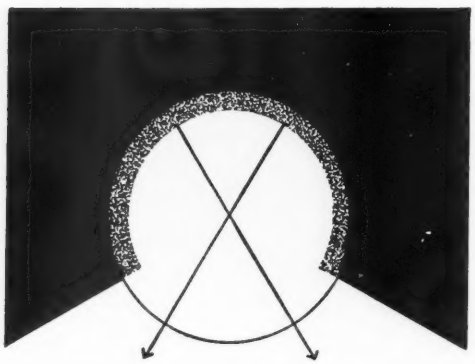

This cross-section of a "Reflectalite" tube shows the diffusing, reflecting layer of powder inside the glass, which covers approximately 240° of the circumference.

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"Reflectalite" is a fluorescent tube with a built-in reflector. Two-thirds of the tube—that 240° segment where dust and dirt most easily settle—are internally coated with a special powder prior to the application of the normal fluorescent phosphor. The majority of the light output from the tube is therefore reflected down through the 120° "window", as shown in the diagram.

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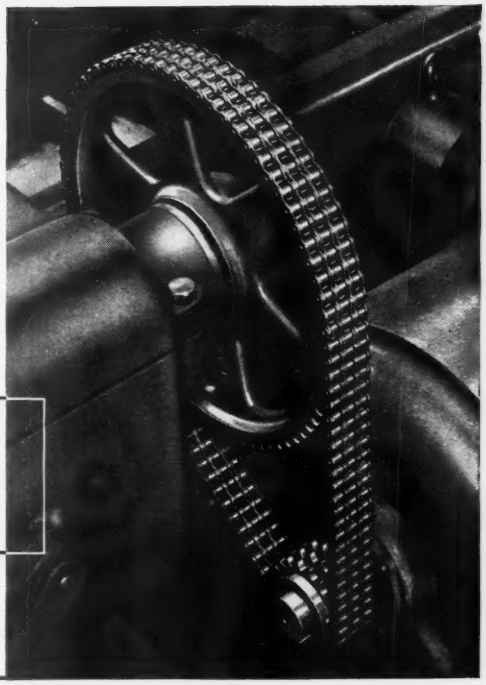

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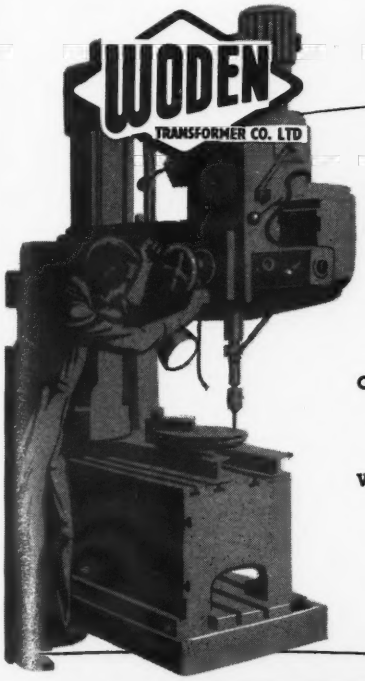

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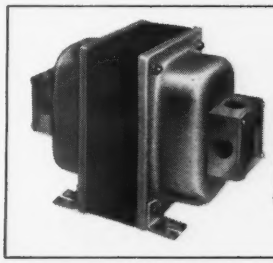

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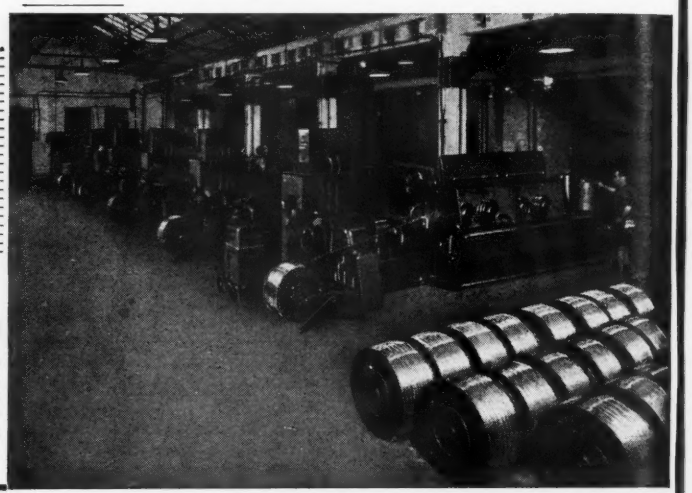

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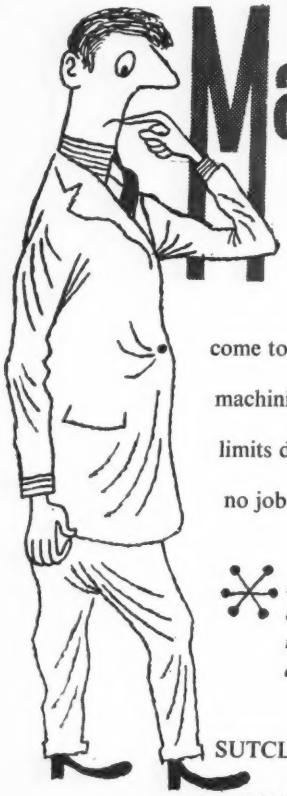

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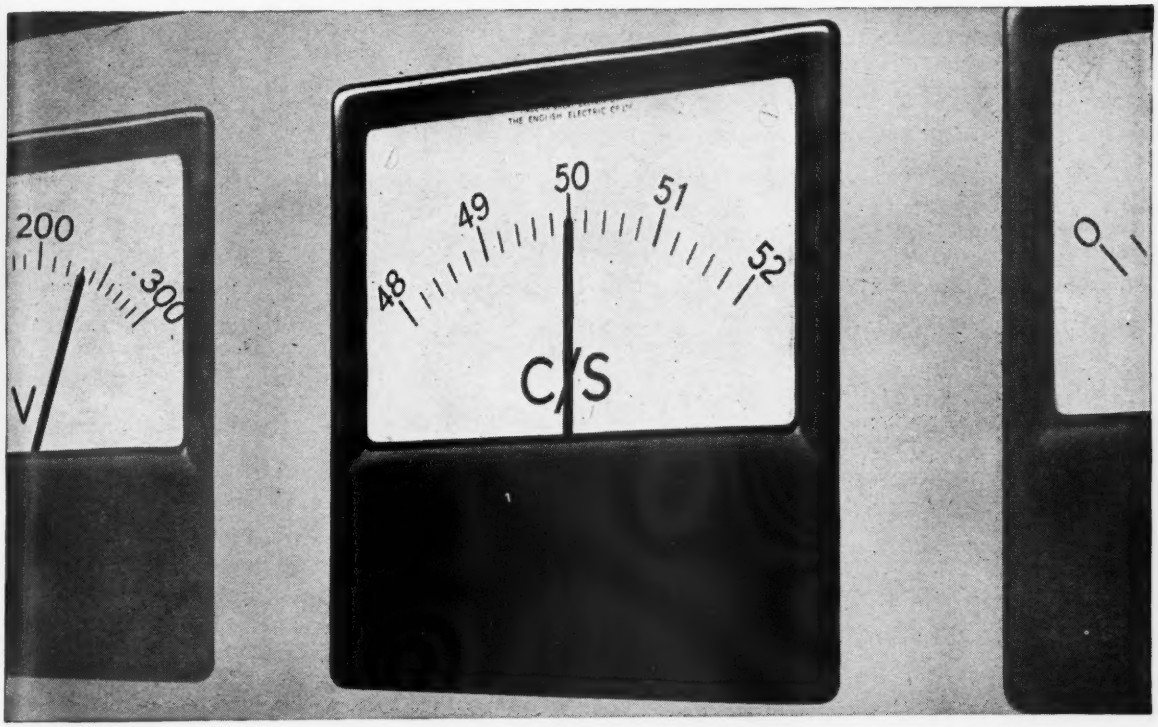

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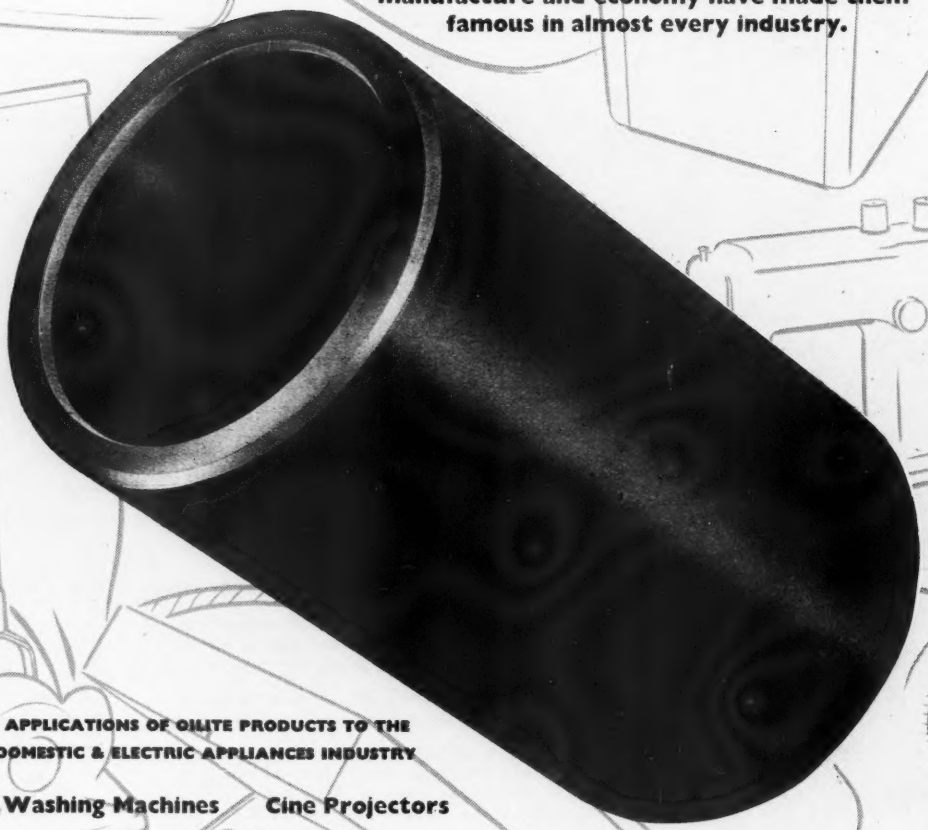

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(Continued from page 89)

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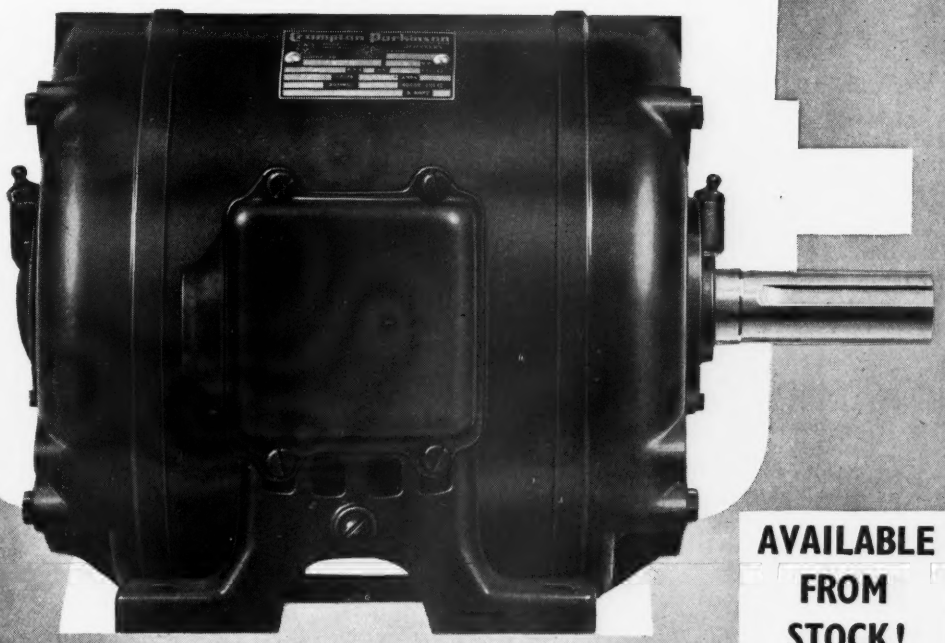
more power in less space

with the new Series 5 motors



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THEY ARE NOW AVAILABLE FROM STOCK IN ALL SIZES UP TO 7½ H.P. AT 1400 R.P.M AND 5 H.P. AT 940 R.P.M.

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- Both ends of the motor are identical. One end cover is a spare for all motors of two frame sizes.
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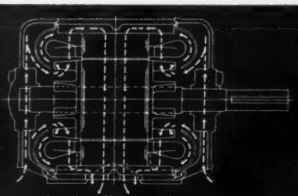

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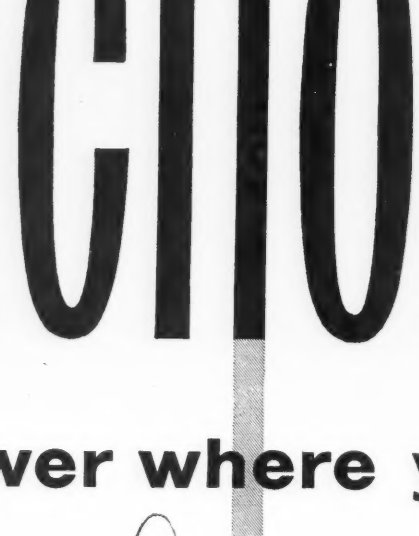
Power for many purposes. Power to drive your own plant efficiently, or to add further distinction to the equipment you make and sell. Power. As much (up to 1 h.p.) or as little as you need, in a wide range of mountings, but always with the reliability for which all G.E.C. engineering is famous. Power, from sturdy, dependable G.E.C. Fractionals. Most sizes and mountings are held in stock—that's another advantage of dealing with the G.E.C.



G.E.C. manufacture many types and sizes of fractional motors for light industrial and domestic drives—whether for your plant or products our engineers will always be pleased to help you choose the right motor for the job.

Fully detailed illustrated publication on application.

The Busy Bee from G.E.C.

THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to First Post on Monday of the week of issue and should be addresssed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF ELLESMERE PORT

Contract No. 218

Public Lighting Installation, Rossmore Road East (A.5032)

TENDERS are invited for the provision and erection of 24 Sodium Discharge Lamps on the above road.

The drawings and the Institution of Electrical Engineers' recommended conditions of contract may be seen by appointment, and a set of tender documents, comprising specification, bills of quantities and form of tender, may be obtained at the offices of the Borough Engineer and Surveyor, Queen Street, Ellesmere Port, on payment of a deposit of one guinea, which deposit will be refunded on the return of the contract documents, or, in the case of a bona fide tender which is accepted and not subsequently withdrawn, on completion of the formal contract between the Council and the successful tenderer.

Sealed tenders in the plain official envelope provided must reach the undersigned by post by not later than noon on Saturday, 24th August, 1957. Tenders received after this date and time will not be considered by the Council, and they do not bind themselves to accept the lowest or any tender.

R. J. BERNIE,
Town Clerk.

Municipal Offices,
Ellesmere Port,
24th July, 1957. 6982

COUNTY BOROUGH OF SUNDERLAND

240 Dwellings, Hylton Red House Estate (Phase II) and 20 Dwellings, Hill View Estate—Electrical Installation

TENDERS are invited for the above works. Particulars and tender form obtainable from the Borough Architect, Grange House, Stockton Road, Sunderland, on payment of £2 2s. deposit, returnable on receipt of a bona fide tender. Cheques payable to "Sunderland Corporation."

Tenders, sealed in the envelope provided, must be received at my office, Town Hall, not later than 22nd August, 1957.

G. S. McINTIRE,
Town Clerk. 6965

COUNTY COUNCIL OF DURHAM

TENDERS invited for supplying light equipment—Kitchen Utensils, Cutlery, Pottery, Glassware and Plastics, Turnery, Textiles, Hollow-ware, Brushes, Electric Lamps and miscellaneous items — for year ending 31st August, 1958.

Forms of tender from undersigned. Completed tenders must be returned by Saturday, 17th August, 1957.

Samples MUST be submitted with each tender.

The lowest or any tender not necessarily accepted.

G. H. METCALFE,
Director of Education.

Shire Hall,
Durham.
25th July, 1957. 6966

CLASSIFIED ADVERTISEMENTS ARE PREPAID

BOROUGH OF BATLEY

Street Lighting Department

TENDERS are invited for the supply of ELECTRIC LAMPS.

Full particulars are obtainable from the Borough Surveyor, Hanover Street, Batley, and tenders must be delivered to the undersigned

L. O. BOTTOMLEY,
Town Clerk. 7017

not later than 28th August, 1957.

SITUATIONS VACANT

MECHANICAL AND ELECTRICAL ENGINEERS IN VARIOUS GOVERNMENT DEPARTMENTS

THE CIVIL SERVICE COMMISSIONERS invite applications for pensionable posts in a wide variety of mechanical and electrical engineering duties.

Candidates must be under 35 on 1st January, 1957, with extension for regular service in H.M. Forces and appropriate civil service. For the Post Office they must be at least 21; for the Ministry of Supply and Ministry of Transport and Civil Aviation (Civil Aviation Organisation) at least 23; for other posts at least 25 on that date.

The achievement of corporate membership of one of the professional institutions (Mechanical Engineers, Electrical Engineers, or Civil Engineers) is essential for most of the posts, but for some posts Associate Fellowship of the Royal Aeronautical Society or (in the Post Office) an Honours Degree in Engineering or Physics will be accepted. Candidates will, however, be admitted provisionally who have passed, or have exemption from, the appropriate sections of the examinations for the stipulated associate membership. Exceptionally a candidate otherwise qualified by evidence of high professional attainment may be admitted. Relevant training and practical experience is expected.

London salary (men) £765 (at age 25) to £1,190. Starting salary according to age up to £1,030 at 34. Candidates entering below age 25 will start at salaries varying from £565 at age 21 to £685 at age 24. Prospects of promotion to higher grades on salary scales £1,215-£1,640 and £1,690-£1,950. Somewhat lower in the Provinces. Women's scales lower but being improved to reach equality with men's scales by 1961.

Further particulars and application forms from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S.85/57. Application forms should be returned by 30th September, 1957. Earlier applicants may be interviewed before that date. 6967

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER (Construction) required in the Sub-Area Engineer's Department, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham.

Salary within range £790/£835 p.a. (N.J.B. K/13).

The duties will include survey work in the general development of rural areas. General experience in the layout and construction of H.V. and M.V. overhead lines is necessary, particularly in the survey and profiling of routes.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager at the above address. Closing date 19th August, 1957. 6990

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division:—

FOURTH ASSISTANT ENGINEER,
BOURNE TRANSMISSION SECTION OFFICE
(Vacancy No. 137/57/ER).

Applicants should have experience in the maintenance and operation of 132-kV overhead lines, transformers and substations.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 5 (£810-£1,035 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 29th August, 1957.

STATION CHEMIST,
BURTON-ON-TRENT POWER STATION (Vacancy No. 141/57/ER).

Previous experience in a power station laboratory is essential and candidates should preferably be Associates of the Royal Institute of Chemistry or hold equivalent qualification.

Candidates must be familiar with the methods of sampling and analysis of coal, water and oil, together with the interpretation and application of the analytical results.

Salary will be in accordance with Class E, Grade 7 (£835-£880 per annum).

Closing date for receipt of applications, 29th August, 1957.

SHIFT CHARGE ENGINEER,
BURTON-ON-TRENT POWER STATION (Vacancy No. 91/57/ER).

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary in accordance with Class E, Grade 7 (£835-£880 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 29th August, 1957.

These appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.
6986

SOUTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Construction and Maintenance) required at Llantwit Fardre in the Central Sub-Area of the Board.

Salary Class L, Grade 7 (£1,235/£1,325) of the N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience, and three referees, should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, to arrive not later than Monday, 26th August, 1957.

R. G. WILLIAMS,
Secretary.

St. Mellons,
Cardiff. 6970

Situations Vacant (continued)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Suffolk Sub-Area

SUB-AREA CONTROL.
THIRD ASSISTANT ENGINEER
(System Control) (94/57R).

Applications are invited for the above appointment on the staff of the Sub-Area Engineer to act as a System Control Engineer on shift duties at Suffolk Sub-Area Control, Woodland, Stowmarket.

Candidates should preferably have had experience in the operation and maintenance of urban and rural networks at voltages up to 33 kV.

A successful candidate who has not previously carried out control duties on an extensive system will be given the necessary training for a specified period.

Salary N.J.B. Class K, Grade 10 (£935-£995) plus 10% shift allowance.

Apply by letter within 14 days to the Secretarial Officer, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk.

BECCLES DISTRICT.
FIRST ASSISTANT DISTRICT
COMMERCIAL ENGINEER
(93/57R).

Candidates must have a good general and technical education and should preferably possess a qualification not less than the Higher National Certificate in Electrical Engineering.

The selected candidate would be responsible to the District Commercial Engineer over the whole commercial field, including sales and commercial development, the preparation of estimates for all types of industrial, agricultural and domestic installations, and such general consumer advisory service as is necessary in this connection.

Salary N.J.B. Class E, Grade 6 (£885-£930).

Apply by letter within 14 days to the District Manager, Eastern Electricity Board, The Grove, Ingate Street, Beccles, Suffolk.

Applications received in response to the previous advertisement (54/57.R) will be reconsidered, and those applicants need not re-apply.

COLCHESTER DISTRICT.
FOURTH ASSISTANT ENGINEER
(95/57R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary N.J.B. Class F, Grade 11 (£685-£730).

Apply by letter within 14 days to the District Manager, Eastern Electricity Board, 36, Osborne Street, Colchester, Essex.

Essex Sub-Area

NORTH ESSEX DISTRICT.
GENERAL ASSISTANT ENGINEER
(96/57R).

Candidates should have had a sound technical education and possess the Higher National Certificate or equivalent qualification.

Salary N.J.B. Class F, Grade 13 (£590-£635).

Apply by letter within 14 days to J. C. Horrell, M.I.E.E., Manager, North Essex District, Cressing Road, Braintree. 7004

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

SUB-AREA ENGINEERING DEPARTMENT, Waterloo Road, Uxbridge, of No. 1 (Southall) Sub-Area. Salary N.J.B. Class L, Grade 13 (£885-£930 per annum, inclusive of London allowance). N.J.B. conditions of service.

The duties of the post will be to assist in the preparation of schemes and estimates for extension and/or reinforcements to overhead and underground H.V. and L.V. networks.

The successful candidate will be required, if eligible, to contribute to the C.E.A. and Area Boards (Staff) Superannuation Scheme.

Applications on forms obtainable from the Sub-Area Secretary, 2-6, Windmill Lane, Southall, Middlesex, and returned to him in envelopes suitably endorsed, not later than 19th August, 1957. 7007

NEW ZEALAND MINISTRY OF WORKS

Professional and Technical Staff

THE Ministry of Works, New Zealand, invites applications for the following vacancies on the Permanent Staff. Positions, qualifications desired and commencing salaries are as follows:

MECHANICAL ENGINEERING DIVISION.

5. MECHANICAL AND ELECTRICAL ENGINEERS.
Corporate Membership of the Institution of Mechanical or Electrical Engineers, London, whichever is appropriate. Commencing salaries £895-£1,465 per annum.

6. BUILDING SERVICES ENGINEERS.
Corporate Membership of the Institution of Mechanical Engineers or of the Institution of Heating and Ventilating Engineers, London. Commencing salaries £895-£1,465 per annum.

7. ASSISTANT MECHANICAL, ELECTRICAL or BUILDING SERVICES ENGINEERS.
A University Degree in Mechanical or Electrical Engineering or Graduate Membership of the above Institutions. Commencing salaries £810-£1,000 per annum.

8. MECHANICAL, ELECTRICAL or BUILDING SERVICES DRAUGHTSMEN.
Ordinary or Higher National Certificate in Mechanical or Electrical Engineering, or equivalent examination, and at least three years' experience in draughting, design and calculations. Commencing salaries £720-£1,000 per annum.

Enquiries, mentioning this paper and quoting reference No. 3/74/133, also stating the type and number of position sought, should be addressed to the High Commissioner for New Zealand, 415, Strand, London, W.C.2. Full details of duties, experience desired, and general information on the conditions of employment in the New Zealand Public Service, together with application forms, will then be furnished. 6949

JOHNSON & PHILLIPS LTD.

require for their

SWITCHGEAR DEPARTMENT

ENGINEERS. Accustomed to dealing with contracts and projects for L.T. and H.T. switchgear up to 11 kV. Applicants must be capable of working on their own initiative and handling generation and distribution schemes.

DRAUGHTSMEN. Should have experience of contract and layout applicable to all types of H.T. and L.T. switchgear up to 11 kV.

CIRCUIT ENGINEERS. Applicants must have experience of preparing protective and control schemes for generation and distribution switchgear.

The company offers first-class conditions of service, superannuation scheme, facilities for canteen, sport, social activities, etc.

Interviews can be arranged for any time, including evenings and Saturdays.

Write, giving details of age, training and experience, to :—

Employment Manager,
JOHNSON & PHILLIPS LTD.
Victoria Way, Charlton,
London, S.E.7

6815

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments :—

THIRD ASSISTANT ENGINEER
(Electrical),
GENERATION (Construction) DEPT.
at DIVISIONAL HEADQUARTERS.

Salary Class AX/DX, Grade 3 or 4, £895-£1,285 per annum plus London weighting.

Applicants should have had experience in the design and installation of the electrical equipment of generating stations and in the preparation of specifications. The salary and status offered within the above range will depend on experience and other qualifications of the applicant.

GENERAL ASSISTANT ENGINEER,
LITTLE BARFORD
GENERATING STATION.

Salary Class G, within the range of Grades 15/13, £540 × £15 to £680 per annum plus 10% shift allowance.

The commencing salary will depend upon the duties and responsibilities.

Duties include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a generating station, and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

ENGINEERING DRAUGHTSMAN,
LITTLE BARFORD
GENERATING STATION.

Salary Schedule D, Grade 6, £595 × £20 to £715 per annum.

Applicants should possess a sound general and technical education. Preference will be given to those with experience in mechanical and/or electrical equipment associated with a modern generating station.

Applications stating age, details of experience and qualifications should be sent to the Controller, Central Electricity Authority, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 24th August, 1957.

W. N. C. CLINCH,
Controller. 6985

CITY OF SALISBURY, SOUTHERN RHODESIA

Vacancy for Power Station Chemist

APPLICATIONS are invited for the vacancy of CHEMIST GRADE 2 (salary scale £1,325 × £50 to £1,525 p.a.) on the fixed establishment staff of the Electricity Department.

Candidates must have had sound general and scientific education, and should hold a recognised degree in chemistry. The post requires experience in the analysis of fuels, oil and water, and familiarity with modern methods of water treatment and boiler water control is essential. Previous experience in the field of power engineering will be a recommendation.

The salary payable will commence at the minimum of the scale, and rise by annual increments. No cost-of-living or other allowances are payable.

Details of the general conditions of service, leave, pension and medical aid funds and travelling expenses may be obtained from the offices of the undersigned. The successful candidate will be required to submit a medical certificate of fitness to the Council's approval, and must also be able to comply with the requirements of the Immigration Authorities.

Applicants are required to submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Applications, suitably endorsed on the envelope, should reach the offices of the undersigned on or before 23rd August, 1957. Air mail paper should be used.

DAVIS & SOPER LTD.
54, St. Mary Axe,
London, E.C.3. 6900

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for post (a) and Corporate Membership for post (b) an advantage.

(a) ASSISTANT ENGINEER (Efficiency and Testing), BRUNSWICK WHARF POWER STATION (Vacancy No. 57/703).

Sound technical training with experience of technical problems, plant testing and efficiency desirable, also knowledge of operating statistics. Salary Class K, Grade 9 = £1,045 p.a.

(b) COMBUSTION TECHNOLOGIST, CHEMISTRY SECTION, CHIEF GENERATION ENGINEER'S (O) DEPARTMENT (BATTERSEA POWER STATION) (Vacancy No. 57/704).

Qualified scientist to work on problems associated with combustion in large boilers. Background in engineering, chemistry or physics is required with bias to solution of practical problems. Knowledge of boiler availability work, fuel selection, coal sampling or air pollution control an advantage. Salary Class AX/EX, Grade 2 = £1,195/£1,460 p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 10 days of this advertisement.

6984

JOSEPH LUCAS (ELECTRICAL) LTD.

Great King Street, Birmingham

AS a result of expansion of our road vehicle lighting development department to meet the growing demands of the motor industry we have vacancies for

ENGINEERS AND PHYSICISTS

of at least H.N.C. standard to work on the following projects. Experience or knowledge of photometric and electrical instruments desirable.

The design and development of vehicle lighting equipment and in particular the development of optical systems for future projects.

Development work on specific problems related to vehicle lighting equipment and the design of laboratory and factory control equipment for these products.

In addition there are vacancies for SENIOR DESIGNERS required to work in close co-operation with car designers and styling engineers on the design of lighting equipment for new car models. Experience in the design of pressed metal components for large quantity production desirable.

All of these positions carry attractive starting salaries and provide excellent prospects for advancement. Staff pension fund.

Apply in writing, stating age, qualifications and experience, to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/156.

127

SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER required, District 221 (Port Talbot) in theWest Central Sub-Area of the Board.

Salary Class G, Grade 8 (£885/£930) of the N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience, and three referees, should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, to arrive not later than 20th August, 1957.

St. Mellons,
Cardiff. 6987

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

AMENDED ADVERTISEMENT

AUTOMATIC TELEPHONE & ELECTRIC COMPANY LIMITED

School of Electronics

APPLICATIONS are invited for the following appointments in the School of Electronics of the Automatic Telephone & Electric Company Limited, Liverpool.

SENIOR LECTURER (one post).
LECTURER (two posts).

The work is postgraduate in nature and involves lecturing on modern electronic technique as applied to communication engineering.

Candidates should possess an Honours Degree in either

(a) Electrical engineering with electronics or telecommunications.

(b) Physics, with electronics and/or mathematics.

Salaries will be in accordance with the Burnham Technical Scale. Persons appointed will be required to join the company's superannuation scheme. Assistance can be given with housing in suitable cases.

Application forms and details may be obtained from :—

The Personnel Manager
AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.
Strowger Works, Liverpool, 7

6973

SENIOR A.C. MACHINE DESIGNER

A WELL-known electrical engineering firm of international repute requires a SENIOR A.C. MACHINE DESIGNER to work with a design group for machines of up to 1,500 h.p. This appointment should enable the successful applicant to lead a group within a comparatively short time.

Salary will be commensurate with experience and qualifications but would probably be in the neighbourhood of £1,500 p.a.

The appointment is to the permanent staff. The company operates a pension scheme. Comprehensive sports club. Housing assistance or, shortly, company housing available.

Write with full details to Box ER.209 L.P.E., Romano House, 399-401, Strand, London, W.C.2.

7015

CENTRAL ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions:—

MAINTENANCE ENGINEER (Mechanical), SOUTHAMPTON GENERATING STATION (S/13.936).

Applicants should have had wide experience in the maintenance of generating station mechanical plant, and be capable of taking control of maintenance staff and supervising turbine and boiler overhauls. Preference will be given to those possessing qualifications leading to corporate membership of a recognised professional institution.

Salary N.J.B. F/7, £885-£930.

GRADE 10 ENGINEERS, PORTSMOUTH GENERATING STATION (S/13,937).

Applicants should have had appropriate experience in a modern generating station, and manufacturing works experience will be an advantage. The successful candidates may be required to undertake shift operational duties. Candidates should possess H.N.C. or equivalent, and preferably possess or be studying for qualifications leading to corporate membership of an appropriate professional institution. This position will afford valuable experience in all aspects of the operation of a generating station.

Salary N.J.B. Class G, Grade 10, £790-£835, plus 10% when on shift.

Special application forms obtainable from P. D. A. Oliver, Esq., Divisional Secretary, 111, High Street, Portsmouth, should be returned by 21st August, 1957. 7005

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Wilton Works

ENGINEERING DESIGNERS

who possess Higher National Certificate or its equivalent, and have experience in the following branches of engineering :

MECHANICAL, CIVIL,
ELECTRICAL, STRUCTURAL,

are required to fill immediate vacancies in the Design Office working on the development of this 2,000-acre factory site, at which is centred much of the company's large expansion programme.

HOUSING : After joining the staff married men will receive a reasonable refund of removal (including travel) expenses and, to assist them in house purchase, facilities are available in approved cases for substantial loans. In addition, legal charges will be advanced. A lodging allowance will be paid for a period to married men selected for these appointments whilst maintaining two homes.

COMMENCING SALARIES : These vary between £535 and £1,000 per annum according to age, experience and qualifications.

The Design Offices are situated in the parklands of Wilton Castle, which lies at the foot of the Cleveland Hills.

Please write to me : Staff Manager, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting reference 414/6.

6975

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

ESTIMATOR for TECHNICAL SALES. Correspondence and capable of preparing control schemes involving automatic motor control gear. Experience essential.

CIRCUIT DIAGRAM DRAUGHTSMAN. Preferably experienced in preparing automatic control gear schemes.

Applicants to have O.N.C. (Electrical). Excellent opportunities with fast growing concern. Pension scheme. Apply to Managing Director, stating experience and present salary. 165

Situations Vacant (continued)

NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER, OPERATION AND MAINTENANCE SECTION, SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM.

Duties will include assistance in the co-ordination and direct supervision of maintenance work on the high-voltage distribution system up to and including 33-kV, 33-kV cable jointing, fault localising and repair.

Applicants should have experience in the operation of large distribution systems, and should preferably be in possession of the H.N.C. in Electrical Engineering or equivalent.

Salary scale £790 × £15 to £835 p.a., Grade K.13. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, by 17th August, 1957.

GENERAL ASSISTANT ENGINEERS, SUB-AREA ENGINEER'S DEPT. AND SUB-AREA CONSUMERS' ENGINEER'S DEPT., BLACKBURN.

Preference will be given to applicants who possess the H.N.C. in Electrical Engineering.

Salary scale £540 × £15 to £585 p.a., Grade K.18. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, by 17th August, 1957. 6972

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

Appointment of Fourth Assistant Engineers, Technical Department

APPLICATIONS are invited for the above appointments in the Protective Gear and Electrical Plant Testing Section of the Technical Department with headquarters for 2 engineers at Newcastle and 1 at Darlington.

The duties consist of the testing, commissioning and maintenance of electrical protective gear and the testing and commissioning of alternators, transformers, switchgear, lines, etc., designed for working at voltages up to 275 kV and their ancillaries.

Applicants should possess qualifications approaching Grad. I.E.E. standard, and experience with H.V. equipment or protective gear would be an advantage.

The salary for these appointments (which are superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Grade 5 (£810-£1,010 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 23rd August, 1957. 6968

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the position of HOUSECRAFT ADVISER in the Chief Commercial Officer's Department at Board Headquarters, presently located at 206, St. Vincent Street, Glasgow, C.2.

Applicants should possess a domestic science qualification. The possession of the E.A.W. Certificate and E.D.A. Salesmanship Diploma would also be an advantage. They should have had extensive experience in the selling and demonstrating of all types of domestic appliances and commercial catering equipment.

Salary and conditions in accordance with Grade 4 of the National Joint Council (Administrative and Clerical Grades) agreement. The position is superannuable.

Applications should be submitted on the standard form, which may be obtained from the undersigned and returned to this office not later than Saturday, 17th August, 1957. Please quote reference C.3/57.

ANDREW A. WALLACE,
P.O. Box 173, Secretary.
351, Sauchiehall Street,
Glasgow, C.2.
29th July, 1957. 7006

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

REPEAT ADVERTISEMENT

APPLICATIONS are invited from engineers with experience in the commercial side of electricity supply work, including contracting, for appointment as FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER in the Stirling District of the Area.

Technical qualifications of at least Higher National Certificate standard are required.

The post is superannuated and the salary will be within the scale of £885/£930 (N.J.B. E.6).

The successful candidate will be required to reside in the District and within reasonable distance of the place of appointment.

Applications are to be submitted on forms, which can be obtained from the undersigned, not later than 31st August, 1957.

JAMES G. CURTIS,
Woodlands, Area Manager.
St. Ninians Road,
Stirling.
24th July, 1957. 6928

TELEPHONE CABLE ENGINEER

for a wide range of duties associated with technical control in the manufacture of paper and thermoplastic telephone cables. The work involves the investigation of processes, the study and analysis of test data and the technical supervision of experiments.

Technical training should be to Higher National Certificate level in electrical engineering. Salary will be assessed generously according to age, qualifications and experience.

Prospects and conditions of employment are excellent, including bonus and superannuation schemes, five-day week, etc.

Please submit applications

to

Works Personnel Officer,
Reference P/2,
British Insulated Callender's Cables Limited,
Prescot, Lancashire.

6974

CHARTERED ENGINEERS

CONSULTING ENGINEERS

offer

OPPORTUNITY FOR INTERESTING, VARIED AND RESPONSIBLE WORK

to

CHARTERED ENGINEERS with sound experience of electrical power generation and transmission.

Bonus and pension schemes.

Salary according to qualifications and experience.

Applications, not later than 19th August, 1957, giving full details of age, qualifications and experience, to Preece, Cardew & Rider, 8, 10 & 12, Queen Anne's Gate, Westminster, London, S.W.1.

7016

CENTRAL ELECTRICITY AUTHORITY

Headquarters

Second Assistant Engineer (Electronics)

APPLICATIONS are invited for the appointment of a SECOND ASSISTANT ENGINEER in the Plant Design Branch at Headquarters in London.

Duties will primarily be to assist in the investigation of problems associated with the application of electronic equipment to power station control and instrumentation, an important part of the work being the critical assessment from the points of view of both reliability and performance of equipments which are commercially available. The successful applicant may also be required to give assistance in connection with problems of control and instrumentation generally.

Candidates should have a degree in electronic engineering, or comparable technical qualifications, and practical experience in the design or manufacture of electronic equipment. Some knowledge of power station control and instrumentation would be an advantage.

Salary within the scale £1,210-£1,570 p.a.

Application forms obtainable from Secretary's Office (Establishments), Central Electricity Authority, Applications Section, Winsley Street, London, W.1, to be completed and returned by 31st August. Quote ref. ER/340. 6952

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

APPLICATIONS are invited for the appointment of FOURTH ASSISTANT ENGINEER in the Steam Testing Department with headquarters at Dunston Power Station for work on ultrasonic crack detection.

Persons who previously applied for this appointment need not re-apply as they will automatically receive consideration.

Applicants should preferably have a Higher National Certificate in Electrical Engineering and a knowledge of electronics would be an advantage.

The salary for the appointment (which is superannuable) will be in accordance with Grade 6, Schedule B, of the National Joint Board Agreement (£710-£910 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 31st August, 1957. 6969

HUDDERSFIELD CORPORATION PASSENGER TRANSPORT DEPARTMENT

Appointment of Technical Assistant (Engineering)

APPLICATIONS are invited for the above position on the permanent staff. Salary A.P.T. Grade II (£610-£692 per annum).

Applicants should have a Higher National Certificate in Electrical Engineering and also drawing office experience.

Duties will include technical development on both electrical and mechanical equipment fitted on motor buses and trolley buses, and also supervisory control of traction substations. Appointment is superannuable and subject to medical examination.

Full particulars, including age, experience and names of two referees, to reach the undersigned not later than Saturday, 24th August, 1957.

H. MUSCROFT,
John William Street, General Manager.
Huddersfield. 6916

ELECTRICAL ENGINEER

SAUNDERS-ROE Ltd. urgently require an ELECTRICAL ENGINEER, preferably with a suitable degree or H.N.C., for interesting experimental work in connection with aircraft electrical installations.

Applicants are invited to send full particulars of age, experience, salary, etc., to Personnel Officer, Saunders-Roe Ltd., Osborne, East Cowes, Isle of Wight, quoting ref. ER/63. 6993

AIR MINISTRY

STATION ENGINEERS (Boilerhouse) required for shift work at Sealand, Near Chester, Greenham Common, Berks and London Airport. Quals. required (a) apprenticeship of not less than 3 years as fitter; (b) technical education to O.N.C. (Mechanical) or equiv. standard; (c) experience in the operation and maintenance of boilerhouse plant (experience of high pressure water boilers or water tube steam raising boilers and chain grate stokers an advantage). Duties supervisory.

Commencing salary according to age, quals. and exp. on range £620-£780 per annum, Greenham Common and Sealand or £640-£805 London Airport, plus shift allowance of 6s. 6d. a shift. Lodging allowance payable in certain circumstances. Appointments non-pensionable. Normally only natural born British subjects.

Write giving age, full details of quals. and exp. to P.E.89, City of London Employment Exchange, Professional and Executive Register, 1-6, Tavistock Square, London, W.C.1. No original testimonials should be sent. Only candidates selected for interview will be advised. 256

CITY OF LEEDS EDUCATION COMMITTEE

Leeds College of Technology, Cookridge Street, Leeds, 2

Principal: C. Chew, M.Sc.Tech., F.R.I.C.

DEPARTMENT OF ELECTRICAL ENGINEERING AND PHYSICS

APPLICATIONS are invited for the post of LECTURER in Electrical Engineering. Applicants should have suitable qualifications with appropriate teaching and industrial experience and should be able to offer telecommunications or Electronic Engineering. Salary scale £1,200 × £30 to £1,350.

Further particulars and form of application, to be returned by the 6th September, 1957, may be obtained by sending a stamped foolscap envelope to the Principal of the College.

GEORGE TAYLOR,
Chief Education Officer.

Education Dept.,
Leeds, 1. 6992

CHIEF ENGINEER, TELECOMMUNICATIONS DEPT., MAURITIUS

TO be responsible for the Engineering Branch, particularly for the installation and maintenance of C.B. and automatic exchanges, training of technical staff, and as necessary to take charge of the department.

Permanent and pensionable appointment or contract appointment for three years. Salary £1,327 10s. p.a. plus cost-of-living allowance. Contract gratuity £50 for each three months' resident service. Free passages for officer, wife and up to three children. Quarters, if available. Generous leave.

Candidates must be A.M.I.E.E. or be exempted from the Institution's examinations, and have considerable practical experience in maintenance and installation of telecommunications equipment, particularly automatic exchanges.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving age, qualifications and experience, quoting BCD.133/52/01. 6991

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN required at the No. 2 Sub-Area Headquarters, Sandiway House, near Northwich, Cheshire.

Salary within range £595/£715 p.a. (N.J.B. Schedule D, Grade 6), with prospects of progress to Grade 5 (£760/£860 p.a.).

Appointment subject to medical examination. Pension scheme.

Applicants should have had experience in the electricity supply industry, and be conversant with substation construction, H.V. and L.V. plant layout, and in the preparation of switchgear wiring diagrams. Possession of the Higher National Certificate in Electrical Engineering advantageous.

Application forms obtainable from the Manager at the above address. Closing date 19th August, 1957. 6988

ASSISTANT SECRETARY

required by ELECTRICITY AUTHORITY OF CYPRUS for two tours of 24 months in first instance, with prospect of permanency.

Salary (including overseas and temporary allowances and annual bonus) £1,808 rising to £2,054. Outfit and settling-in allowances totalling £35 (£75 if accompanied by wife). Contributory superannuation and medical funds. Grants for children's education in certain circumstances. Free quarters or allowance in lieu. Free passages for officer, wife and three children. Leave on full pay at 3½ days per month of residential service and local leave in addition.

Candidates must possess a recognised secretarial qualification and have had extensive secretarial experience in the electricity supply or similar industry, including experience of establishment and personnel matters and administration of superannuation schemes.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M1B/43812/EF. 6960

DRAUGHTSMAN

required to join a small team engaged on the design and development of instruments for research in the oil industry at

THORNTON RESEARCH CENTRE NEAR CHESTER

Workshop experience and at least three years' drawing office experience on instruments or small electro-mechanical units is essential. Attractive pension scheme.

Applications should be addressed to

"SHELL" RESEARCH LIMITED
Staff Department (R/T)
16, Finsbury Circus, London, E.C.2

7012

FEDERATION OF RHODESIA AND NYASALAND

Electrical Engineer, Ministry of Power

APPLICANTS should be Associate Members of the Institution of Electrical Engineers or hold other equivalent qualifications. Experience in the administration of technical electricity regulations would be an advantage.

The successful applicant will be required to advise on technical regulations and other technical aspects of the administration of the Federal Electricity Act; and to inspect and advise on electrical installations within the Federation. He will be stationed in Salisbury, but will be required to travel extensively.

Commencing salary £1,700 p.a. on the scale £1,700 × £75 to £1,850 p.a.

Application forms and further details from the Secretary (R), Rhodesia House, 429, Strand, London, W.C.2.

Closing date 24th August. 6950

CENTRAL ELECTRICITY AUTHORITY

Headquarters

ASSISTANT ENGINEER (Electrical) required in the Production Inspection and Test Sub-Branch in London.

Recent first-hand experience of production of electrical plant, etc., in manufacturers' works is essential, and candidates should preferably have qualifications equivalent to Grad. I.E.E.

The successful candidate will be required to carry out duties in connection with the production of all types of electrical equipment for power station construction.

Salary £1,105-£1,315 per annum.

Applications stating age, qualifications, experience, present position and salary to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 21st August. Quote ref. E.R./343. 6951

NORTH WESTERN ELECTRICITY BOARD

Second Assistant Chief Engineers

APPLICATIONS are invited from suitably qualified engineers for two posts as SECOND ASSISTANT CHIEF ENGINEERS at the Board's Headquarters, Cheetwood Road, Manchester, 8.

The successful applicants will be responsible to the Assistant Chief Engineer (Planning and Design) and duties will include long-term planning, system development, design and the construction of major substations.

Salary will be in accordance with Grade 4 of the N.J.M. Scales (£1,825 to £1,975) (subject to revision).

Applications, giving names of three referees, must be sent to the Secretary, North Western Electricity Board, Cheetwood Rd., Manchester, 8, so as to be received not later than Monday, 26th August, 1957. 6971

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

Assistant Engineer (Electrical)

APPLICANTS must be at least Graduate Members of the Institution of Electrical Engineers and have passed the Institution examination or recognised exempting examinations.

Salary scale £700 × £25 (3) × £30 (1) × £35 (6) to £1,015 plus £20-£50 London weighting. Starting salary may be above minimum having regard to experience. Whitley Council conditions. Superannuable.

Apply, giving age, qualifications (with dates) and experience, together with the names and addresses of two referees, to Secretary, North West Metropolitan Regional Hospital Board, 11a, Portland Place, London, W.1, by 19th August, quoting reference 566. 6953

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR DEMONSTRATOR required in the North Wirral District, to operate from Birkenhead.

Salary within range £600/£660 p.a. (N.J.C. Grade 2).

The possession of a diploma in domestic science, or other approved certificate, would be advantageous.

The successful applicant would be required to prepare demonstration programmes, to advise consumers in the selection and use of electrical appliances, to give assistance in the Board's service centres and, when necessary, to supervise demonstrators engaged in this work.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, should be returned not later than 15th August, 1957. 6989

ADMIRALTY

ELECTRICAL DRAUGHTSMEN experienced in all electrical engineering techniques required for unestablished appointments in BATH. Must be British subjects aged 21 and upwards, and have had basic training including apprenticeship (or equivalent) and drawing office experience in factories or shipyards, preferably with O.N.C. or H.N.C.

Starting pay according to age up to £680 (age 28 and above); higher for candidates with wide experience. Annual increments up to £780 maximum. Five-day week, 18 days' annual leave.

Prospects of permanency and promotion. Substantial grants towards travelling expenses for all candidates called for interview.

Apply giving age, technical qualifications, details of apprenticeship (or equivalent) and experience to Admiralty, C.E.II (114), Empire Hotel, Bath. 7011

CORPORATION OF MANCHESTER

City Architect's Office

APPLICATIONS invited for appointment (permanent) of ASSISTANT ELECTRICAL ENGINEER. Salary A.P.T. Basic Grade £707 to £861 per annum.

Forms of Application from the City Architect, P.O. Box 488, Town Hall, Manchester. Returnable by 23rd August. 7008

***Situations Vacant** (continued)*

MIDLANDS ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER required in the Gloucester District of the Central Gloucestershire Sub-Area.

Applicants should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable.

Salary £790/£835 per annum (N.J.B. Grade F.9). Superannuable.

Apply by letter within fourteen days, stating age, experience, present salary and position, to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Road, Gloucester.

A. STEPHENS,
Secretary.
7003

NEWMAN INDUSTRIES LIMITED

in connection with their expansion programme in the manufacture of electric motors require a

DEPARTMENTAL MANAGER

to control one of their decentralised production units.

The work would comprise the supervision of production control, process planning, material control, work study and labour.

Only applicants who are engineers with experience of organising production will be considered.

Age preferred, 30-38 years.

Applications to :—

The Managing Director,
NEWMAN INDUSTRIES LIMITED,
Yate, Bristol
6828

SALES ENGINEER

YOUNG engineer required for outside technical sales staff in Midlands Area for sale of Power Factor Correction Capacitors.

Applicants should be keen, energetic and able to drive a car.

The successful applicant will receive brief training and have access to established contacts and every assistance from existing staff.

Reply:—

Sales Manager,
BRYCE ELECTRIC CONSTRUCTION CO. LTD.,
Kelvin Works, Hackbridge, Surrey
6862

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER, Consett District (Stanley). Duties include commercial and domestic development and the application of electricity on farming. Graduate Membership I.E.E. and/or H.N.C. desirable. Salary Schedule A, Class E, Grade 9, £740/£785. N.J.B. conditions of service.

Applications stating age, qualifications and experience, to be received by the Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 7009

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of a FOURTH ASSISTANT ENGINEER, Operation and Maintenance Section, Sub-Area Headquarters, Sunderland.

Applicants should have H.N.C. in Electrical Engineering, or equivalent qualification, and experience in all classes of operation and maintenance work.

Salary Schedule A, Class L, Grade 13, £835/£880. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Secretary (Establishments), North Eastern Electricity Board, G.P.O., Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 6983

BICC LIMITED

have the following vacancies for Draughtsmen in Central London :—

TRAINEE DRAUGHTSMAN,
First Year Ordinary National Course.

DRAUGHTSMAN
with Ordinary National Certificate.

LEADING DRAUGHTSMAN
with Higher National Certificate.

Interesting work offering good prospects for advancement. Five-day week. Pension fund. Applications in writing to Personnel Officer, British Insulated Callender's Cables Limited, Surrey House, Temple Place, London, W.C.2, reference L.12. 6976

SIMPSON BROTHERS (OF HAPTON) LTD.

have the following vacancies.

FOREMAN for electrical assembly shop. Experience of light fabrication and machining an advantage.

FOREMAN for coil winding and transformer shop.

ASSISTANT to Production Manager for light electro-mechanical production.

TECHNICAL REPRESENTATIVE. Knowledge of control gear and transformers an advantage.

Accommodation available.

Apply by letter to Magneto Works, Hapton, Burnley. 6954

SURREY COUNTY COUNCIL

APPLICATIONS invited for appointment of ELECTRICAL INSTALLATIONS DRAUGHTSMAN GRADE I, £543 5s. to £625 5s. p.a. plus London allowance of up to £30 p.a. according to age.

Full details, present salary and 3 copy testimonials to County Architect, County Hall, Kingston-on-Thames, as soon as possible. 7010

A.C. control gear sales engineer for Newcastle and North-East England. H.N.C. or equivalent qualifications with previous experience in control gear desirable. Good starting salary with excellent prospects of advancement. Applications to Technical Director, Kloeckner-Moeller England Ltd., 28 Oxford St., Manchester 1. 6878

APPLICATIONS are invited from electrical engineers aged 28 to 35, holding at least H.N.C., for a position in design office of specialist medium-size company 30 miles south of London. Salary £1,000 p.a. offered for at least 7 or 8 years' experience in designing wide range of H.V. and L.V. transformers. New housing available. Superannuation scheme. Apply in strictest confidence, giving full details of scholastic qualifications and technical experience, to—Box 6816.

ASSISTANT departmental manager required by electrical wholesale company in London S.W.1 area. Knowledge of trade essential. Permanent pensionable position.—Box 6994.

ASSISTANT electrical engineer required with knowledge of estimating for all types of contracts. Midland office. Full details with application to—Box 6834.

ASSISTANT manager required for expanding transformer department. Must be capable of designing most types of transformers up to 250 kVA. Good prospects for the right man. Annual bonus scheme.—Austin Walters & Son Ltd., Ayres Road, Trafford, Manchester, 16. 6940

CHIEF inspector required for Hemel Hempstead, Herts, area. Experienced in Ministry and A.I.D. contracts incorporating electrical and precision engineering. Salary £750 upwards, according to experience. Must be fully conversant with modern methods and able to take complete control.—Box 6904.

CROMPTON PARKINSON Limited require a chief technical engineer at their Derby cable works. Applicants should be Corporate Members of the I.E.E. or equivalent and should possess an intimate knowledge of the design and manufacture of paper, rubber and thermoplastic insulated cables up to and including 33 kV. The position offers exceptional scope to the right man and provides excellent working conditions with superannuation fund facilities. Applicants should provide full details of past experience and qualifications, together with salary expected. Applicants should be addressed to the Director and General Manager, Derby Cables Ltd., Alfreton Road, Derby. 6818

CONSULTING engineer requires junior electrical engineer/draughtsman, aged 21/25, to be employed in installation design of factories, offices, schools, etc. Superannuation scheme, meal vouchers. Applicants must state salary required, qualifications, age, educational background and experience.—G. H. Buckle & Partners, 2, Harrington Gardens, London, S.W.7. 6955

DRAUGHTSMEN required in electrical drawing office of large steel works. Electrical experience desirable but not essential. Position gives valuable opportunity to applicants having varying degrees of experience. Apply—Labour Manager, Samuel Fox & Company Ltd., Stocksbridge Works, Nr. Sheffield. 6781

EDMUNDSONS CONSTRUCTION Co. Ltd. have a vacancy for a contracts engineer in their London office. Good prospects in expanding business. Superannuation scheme. Reply stating age, experience and salary required to the Area Manager at 24/30, Gillingham St., London, S.W.1. 6979

EDMUNDSONS CONSTRUCTION Company Limited invite applications from those suitably qualified with a view to taking responsibility for the company's electrical contracting activities in the North of England, operating from offices in Leeds. Applications, which will be treated with the strictest confidence, to be made in writing and addressed to the Chairman of the Company at 240/250, Ferndale Road, London, S.W.9. Employees of the company have been notified of this vacancy. 6980

ELECTRICAL contractors, North-West Kent area, require services of a part-time or free-lance estimator, experienced in general lighting, power and heating systems. All enquiries treated with strict confidence.—Box 9061.

ELECTRICAL design draughtsman required in London by consulting engineers. Must have experience lighting/power and distribution layouts for large buildings, factories, airfields, etc. Permanent post with good prospects and generous salary. Contributory pension scheme and five-day week.—Box 7013.

ELECTRICAL engineer required by electrical contracting company for service in British West Africa. Must have experience on preparation of specifications and estimates and supervision of contract work. Remuneration between £1,300 and £1,600 p.a. depending on qualifications and experience. Tours normally 20 months followed by 4 months' leave with free passages. Pension scheme, family allowances and free furnished quarters in Africa. Please write giving age, whether married or single, and brief details of education, qualifications and experience to—Box 6995.

ELECTRICAL engineer required in London area for the design of electrical installations in all types of buildings. Must be capable of running a project through all its phases, including site supervision. Write giving full details of qualifications, experience and salary required to — Box E.R.200, L.P.E., Romano House, 399-401, Strand, London, W.C.2. 6948

ELECTRICAL engineers required for consulting engineers' office. Senior to take charge of projects, carrying out the design of lighting and power installations for all classes of buildings. Also intermediate designer-draughtsman for the same class of work. Five-day week, spring and summer holidays, pension scheme and luncheon vouchers. Apply in writing, stating age, experience and salary required, to J. Roger Preston and Partners, 15, North Audley Street, London, W.1. 6978

ELECTRICAL sales engineer, aged 23 to 30, required in export department (London) of well-known manufacturers of electric motor starting and control gear. Position offers scope, good salary, prospects, and is pensionable. Write stating age, present salary and experience. —Box 6880.

FOR Singapore and Malaya: Sales or commercial engineer with sound electrical experience, age 24 to 28 years, single, wanted by leading engineering company offering attractive conditions of employment and prospects. Please send applications to Box 6957, stating particulars and experience.

FOREMAN electricians required by contractors in London W.C.2 area. Works in Greater London. Good prospects and superannuation scheme available for right men. All applicants will be interviewed.—Box 9065.

LARGE public company requires for new large subsidiary factory first-class works technician for the manufacture of universal motors suitable for portable tools and similar appliances. Must combine best works and technical design experience, able to evolve new motor types and be up-to-date with the latest modern mass production and factory management methods. Suitable candidate offered highly attractive contract, together with housing assistance and other long-term benefits. Present staff advised. Write fully in confidence to Technical Director.—Box 6907.

MANAGER : A vacancy exists for a man of high ability to take charge of the sales, manufacture and development of a technical product having an annual turnover approaching £2,500,000. Knowledge of electrical engineering desirable but not essential. Candidate must have drive, initiative and be able to lead a team of senior executives. A salary in excess of £2,000 will be paid to the right man, together with use of a company car and participation in a generous non-contributory pension scheme. Applications giving a brief summary of qualifications and experience to—Box 6981.

OPPORTUNITY for keen man (about 30) to take charge of sales office of old-established London firm in lighting industry. Experience in lighting fittings sales activities desirable but not essential. Applicants must have good knowledge of the electrical trade and be accustomed to dealing with users, contractors, architects, etc. Good prospects for keen organiser. 5-day week; pension fund. Write fully, stating age, experience and salary range.—Box 6964.

PROTECTIVE gear engineer required by Cooke & Ferguson Limited, switchgear specialists. Applications are invited from engineers preferably educated to at least Higher National Certificate standard for a position requiring a working knowledge of the various types of protective schemes and some experience of current transformer performance. Advisory supervision of tests both in the works and on site is involved. The post is permanent and pensionable. Applications in writing stating age, experience and salary required to be submitted to — Personnel Officer, Victoria Street, Openshaw, Manchester, 11. 6958

SALES representative required for Northern area (Manchester, Lancashire, Yorkshire, etc.) by manufacturers of scientific and electrical instruments. Candidates should have a background of electrical experience. H.N.C. preferred, together with sales experience. Established contacts in all branches of industry in the area will be advantageous. The company offer first-class salary and conditions of employment, together with superannuation and life assurance scheme. Initial applications should contain full academic background together with a summary of posts held to date.—Box 6996.

SENIOR assistant engineer required for the development of specialised electrical transmission equipment involving heavy currents together with the design and execution of contracts for work of this nature. Candidates should be qualified to degree standard or equivalent in either mechanical or electrical engineering, and should preferably have experience in some form of power transmission engineering. A person in the age range 30 to 40 would be preferred. Five-day week. Pension fund. Applications in writing to Personnel Officer, British Insulated Callender's Cables Limited, Surrey House, Temple Place, London, W.C.2. Reference L.13. 6977

SENIOR electrical engineer required for interesting and varied work. A.M.I.E.E. and/or graduate, with experience in modern power distribution, rotating and static equipment, electronics, instrumentation, design of automatic controls, modern heating techniques, etc. Age 30 to 40 with knowledge and experience of modern labour control and administration. Salary commensurate with qualifications and experience. Apply in writing to Personnel Manager, Ferodo Limited, Chapel-en-le-Frith, Via Stockport. 6882

SHIFT charge engineers required for the Baghdad Electricity Services. Experience in medium-pressure oil-fired boilers, turbo-generators up to 15 MW, electrical control gear, 11-kV and L.T. power house auxiliaries. Monthly salary ID.110 plus high cost of living. Provident fund exists. House accommodation with heavy furniture or house allowance. Three-year contract. Three months' home leave on full pay after two consecutive summers in Iraq. Age limit 36.—Box 6997.

SOUTH WALES SWITCHGEAR Ltd., Blackwood, Mon., have vacancies for experienced draughtsmen required to undertake application design work in connection with 11-kV and 33-kV metalclad switchgear contracts. Applicants should preferably hold a Higher National Certificate and should have good experience of switchgear manufacturing and design technique. Applications giving full particulars of age, experience and education to the Personnel Manager. 6959

SOUTH WALES SWITCHGEAR Ltd. have vacancies for assistant engineers in their expanding organisation, to assist in the design and manufacture of electrical switchgear and transformers. Applications are required from men carrying a Diploma or Higher National Certificate, who have already received training in mechanical or electrical engineering. Applications should be sent to the Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon, giving details of age and training. 7014

STOREKEEPER for switchgear and conduit fittings, preferably able to drive. Good wages and excellent prospects for keen man. Write or phone—Leslie Maynard Ltd., 306a, Fulham Road, London, S.W.10 (Flaxman 3526). 158

TECHNICAL assistant required by expanding electrical manufacturers in Redditch to assist with estimates and contracts. Higher National Certificate or Graduate I.E.E. preferred but not essential. Excellent prospects and pension scheme. Write stating age, qualifications, experience and salary required to—Box 6890.

TRANSFORMER testing. Chief of test required with experience in testing high-class transformers, L.F. chokes and power transformers up to 250 kVA. Salary commensurate with experience. Apply — Willesden Transformer Co. Ltd., Manor Park Works, Manor Park Road, Harlesden, London, N.W.10. 312

TWO stores assistants required by progressive London wholesaler. Good knowledge of trade desirable. Good prospects ; non-contributory pension scheme. Apply in writing to—The National Electrical Supplies Co. Ltd., 240/244, King Street, Hammersmith, London, W.6. 6835

WAREHOUSE clerk, electrical experience an advantage, required by large firm of ships' store dealers in the Royal Albert Dock. Age approximately 30-35 years. Hours 8 a.m. to 5 p.m. and 8 a.m. to 12 noon Saturdays, with some Saturdays free. Staff assurance and pension schemes in operation. Good salary according to age and experience. Apply to—Mr. Mackintosh, Duncan Wallet & Co. Ltd., Central Stores, Royal Albert Dock, London, E.16. 6998

WORKS manager to take complete control of manufacture of medium-sized electrical rotating equipment. Applicants (30/45) should be well versed with modern manufacturing processes, have drive, enthusiasm and preferably experience in manufacture of electrical apparatus. Write in confidence giving full details of experience, salary required and age.—Box 6956.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

CABLE jointer seeks position in London or Nth. Kent area. Experienced up to 33 kV, also used to live work.—Box 9057.

ENGINEER (36), M.T.T.I., recently returned from Australia, requires situation. Twenty years' extensive field service and repair shop experience in fault location, rewinding, redesign and repair of all types rotating electrical machinery and associated equipment.—Box 9064.

FOREMAN/supervisor (37), experience overseas contracting large building installations, H.V./L.V. distribution, desires further overseas employment.—Box 9062.

ARTICLES FOR SALE

B. C. S.

LARGE comprehensive stock of Brand New Spare Parts for GENERAL MOTORS Model 16-278A Diesel Engines available. Price list forwarded on request.

B.C.S. ENGINEERS & CONTRACTORS LTD.
3, Castle Street, Cardiff
(Tel.: Cardiff 29246) 232

B. C. S.

Available for Immediate Delivery

ONE 600-kW SULZER Diesel Generating Set, 220/440 volts D.C., complete with auxiliaries, spares, etc.

One 850-kW SULZER Diesel Alternator Set, 400/440 volts, 3-phase, 50 cycles, 428 r.p.m., complete with auxiliaries, etc.

One 55-kW McLAREN/BRUSH Diesel Alternator Set, 400/440 volts, 3-phase, 50 cycles, 1,000 r.p.m., complete with auxiliaries and switchboard.

Two 20-kW HILL & CO./DELCO Diesel Generating Sets, 120 volts D.C., 1,450 r.p.m., complete with auxiliaries.

Other sets in stock.

B.C.S. ENGINEERS & CONTRACTORS LTD.
3, Castle Street, Cardiff
(Tel.: Cardiff 29246) 231

D.C. MOTORS FOR PROMPT DELIVERY

H.P.	Volts.	Make.	Speed.
250	550	HARLAND	1600
225	250	HARLAND	1450
175	525	E.C.C.	1500
110	220	L.D.C.	1450
80	220	L.S.E.	1450
57	220	G.E.C.	850
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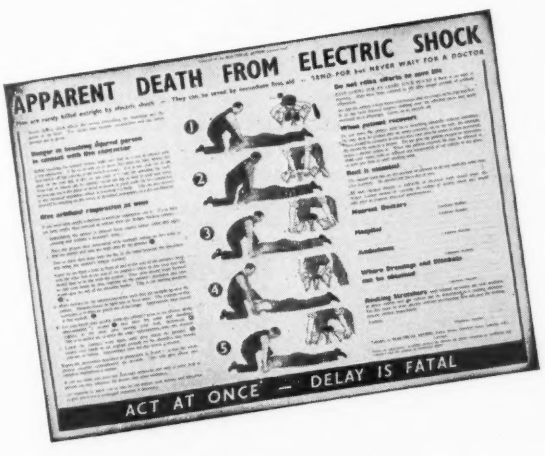

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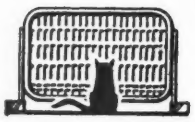

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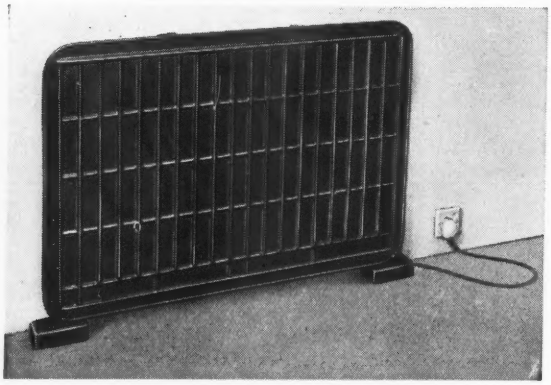

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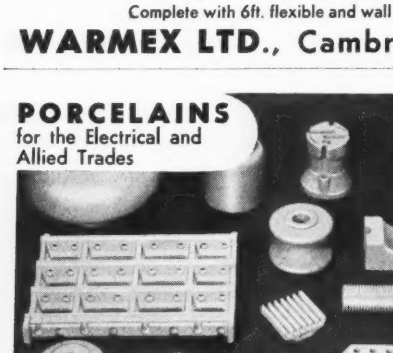

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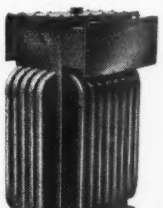

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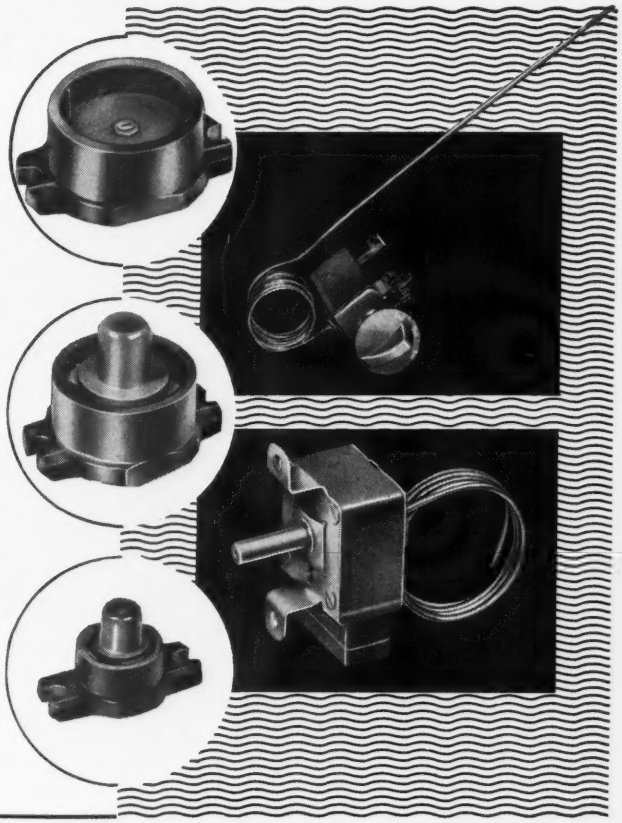

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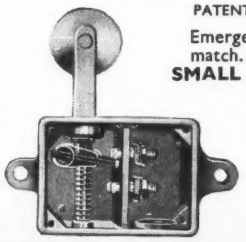

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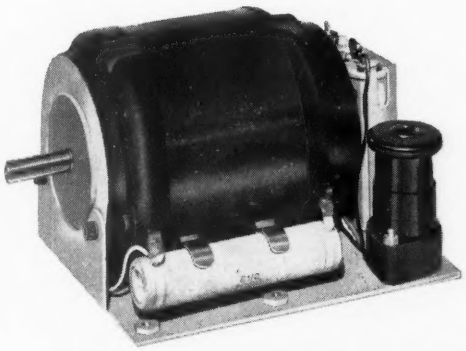

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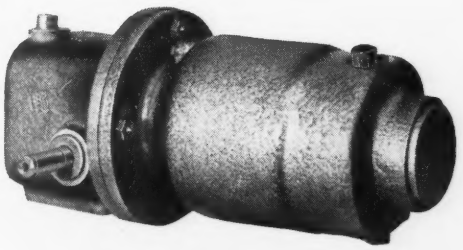

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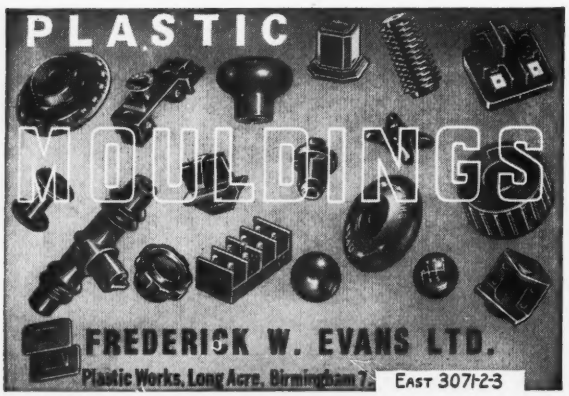

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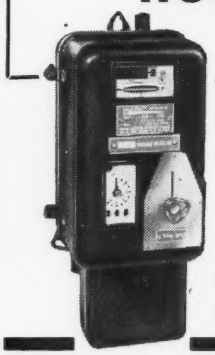

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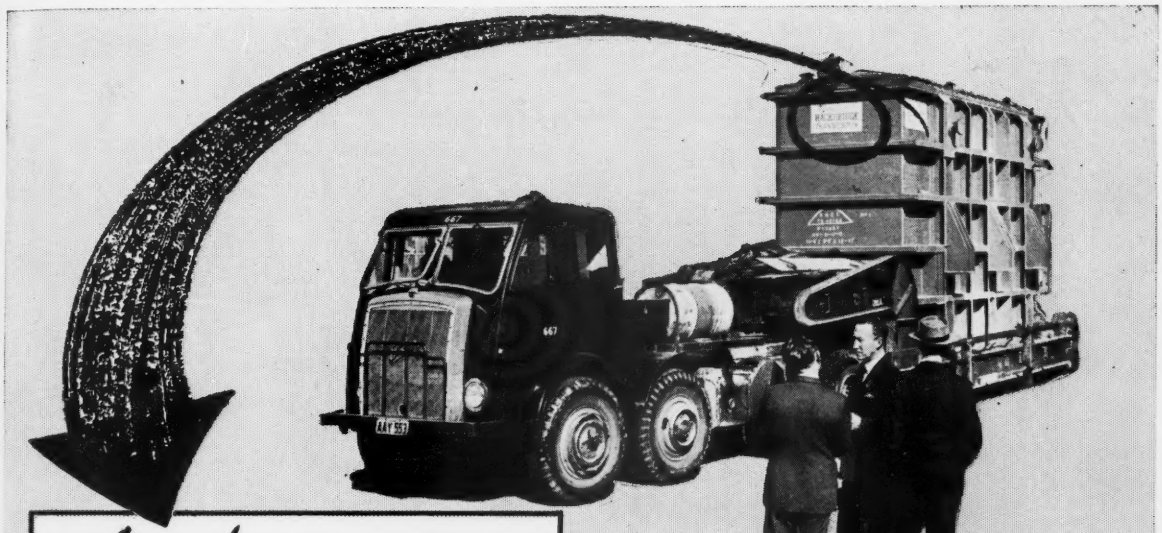

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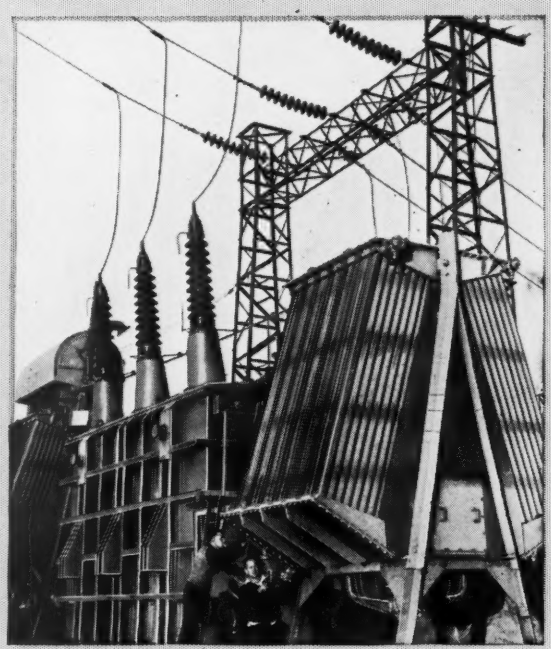

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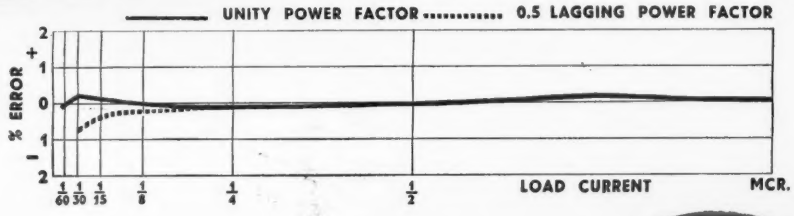

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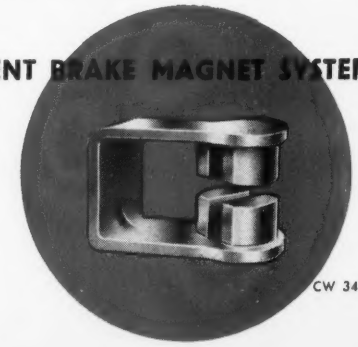

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